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SUMMARY

An investigation has been made in the Langley full-scale tunnel to determine the longitudinal aerodynamic characteristics of a large-scale semispan V/STOL tilt-wing configuration having a single propeller which rotated in such a direction that the propeller blades rotated upward at the wing tip and downward near the root. The wing had a chord of 0.6 propeller diameter, a Fowler flap, an aspect ratio of 4.05 (2.025 for the semispan), a taper ratio of 1.0, and an NACA 4415 airfoil section.

The data are presented without detailed analysis, but three results were found to stand out very markedly from a casual inspection of the data. First, the tuft tests showed no stall on the part of the wing immersed in the propeller slipstream at angles of attack well above that corresponding to the peak of the lift curve for the high-thrust conditions corresponding to operation in the STOL range of flight. Second, the wing-flap combination was found to be sufficiently effective to prevent wing stall except in the unprotected center section (judged from tuft-test results) over the entire range of STOL operating conditions covered in the tests, which included the conditions required for descent angles as high as about 20° for each test. And, third, the use of leading-edge high-lift, or stall-control devices was not found to be beneficial in the conditions corresponding to the STOL flight range, evidently because the wing did not stall without such devices.

INTRODUCTION

Most of the aerodynamic research that has been done on the tilt-wing propeller-driven V/STOL configuration in the past has been of an exploratory character and has been obtained with small-scale models. The interest in this type of airplane has now become so substantial, however, that there is a need for large-scale systematic aerodynamic design data for this type of airplane. A program has therefore been inaugurated at the Langley Research Center to provide such information by means of tests of a large-scale semispan tilt-wing-and-propeller model in the Langley full-scale tunnel. Tests have been completed on a model having a single propeller on the semispan wing and having a chord-diameter

ratio of 0.6, a 40-percent-chord Fowler flap, and three different leading-edge flow-control devices - a slat, a droop nose, and a Krueger flap. The investigation covered a range of angle of attack from -20° to 90° and a range of power conditions from zero thrust to that required for hovering. The direction of propeller rotation was such that the blades were going upward at the wing tip. The lift, drag, and pitching moments of the model were measured over the range of test conditions and the flow was observed by means of tufts on the upper surface of the wing. The results of this investigation are presented herein without detailed analysis in order to expedite their dissemination to industry and the military services. A few observations are made, however, of some of the more obvious results.

SYMBOLS

The positive sense of forces, moments, and angles is shown in figure 1. The pitching-moment coefficients are presented with reference to the wing quarter-chord line. The coefficients are based on the dynamic pressure in the propeller slipstream. Conventional coefficients based on the free-stream dynamic pressure can be obtained by dividing the slipstream coefficients by $\left(1 - C_{T,s}\right)$; for example, $C_L = C_{L,s} \Big/ \left(1 - C_{T,s}\right)$.

The coefficients and symbols used in this paper are defined as follows:

C_L lift coefficient based on free airstream, $\frac{L}{qS}$

$C_{L,s}$ lift coefficient based on slipstream, $\frac{L}{q_s S}$

$C_{D,s}$ drag coefficient based on slipstream, $\frac{D}{q_s S}$

$C_{m,s}$ pitching moment based on slipstream, $\frac{M_Y}{q_s S c}$

$C_{T,s}$ thrust coefficient based on slipstream, $\frac{T}{q_s \frac{\pi D^2}{4}}$

b propeller blade chord

c wing chord, ft

D	propeller diameter, ft; also, total model drag, lb
h	width of slat or of flap-slot gap; also thickness of propeller blade
L	total model lift, lb
M_Y	pitching moment, ft-lb
q	free-stream dynamic pressure, $\frac{\rho V^2}{2}$, lb/sq ft
q_s	slipstream dynamic pressure, $q + \frac{T}{\pi D^2/4}$, lb/sq ft
r	radius to element on propeller blade
R	radius of propeller blade (34 in.)
S	area of semispan wing (23.62 sq ft)
T	propeller thrust, lb
α	angle of attack, deg
δ_f	Fowler flap deflection, deg
δ_s	leading-edge-slat deflection, deg
δ_n	droop-nose deflection, deg
δ_K	Krueger flap deflection, deg
ρ	mass density of air, slugs/cu ft
V	free-stream velocity, ft/sec

APPARATUS

The model used in this investigation was a semispan model which would represent the left panel of a full-span wing. The principal dimensions are given in figure 2(a), the propeller blade characteristics are given in figure 2(b), and a photograph showing the model mounted in the Langley full-scale tunnel is presented in figure 2(c). The wing was mounted on the scale balance system in the tunnel so that lift and drag measurements were read directly about the wind axis. At the point where the wing extended through the reflection plane, very soft

sponge rubber was used as a seal to prevent air from leaking through the reflection plane at the wing root.

The model was constructed to allow numerous changes to be made in the test configuration, such as a change of airfoil, leading-edge modification, trailing-edge flap, direction of rotation of the propeller, and wing planform. The basic structure of the wing consists of a heavy steel box-beam spar to which a power train to drive the propellers through spanwise shafting is attached, and around which various airfoil contours can be fitted.

The model configuration for the present tests had a single 68-inch-diameter propeller having the characteristics shown in figure 2(b). The propeller was located spanwise so that the propeller tip extended out to the wing tip. The direction of propeller rotation was up at the wing tip and down at the root. This mode of rotation is sometimes referred to as "with the tip vortex." Propeller thrust was measured by a strain-gage balance which was a part of propeller shaft. The output was fed through sliprings to an indicating instrument. The required values of thrust for each $C_{T,s}$ were set by the operator by changing the speed of the drive motor. The blade angle at the 0.75R station of the propeller was held constant at 17.0° throughout the investigation. The thrust axis was inclined upward 4° from the chord line of the wing to correspond approximately to the zero-lift line of the NACA 4415 airfoil section.

The airfoil used was the NACA 4415 section with a 41-inch chord. This chord length gave a ratio of wing chord to propeller diameter of 0.6. The reference area of the wing based on a semispan of 83 inches was 23.62 square feet, which did not include the area of the tip fairing.

The model had a 40-percent-chord Fowler-type trailing-edge flap which, at the hinge point shown in figure 3, had a deflection range from 0° to 60°. With this hinge position the flap, at a deflection of 50°, was located in a near-optimum position but at a deflection of 60°, the flap nose had rotated to a position behind the trailing edge of the wing. The flap was repositioned for one test to give the same relative gap geometry at the 60° deflection as for the 50° deflection (see fig. 3), and this position has been designated the "alternate hinge point."

The three leading-edge flow-control devices shown in figure 3 were investigated in combination with the flap on this model. These devices were a Krueger flap, a drooped nose, and a leading-edge slat. The Krueger flap, which in the retracted position in actual use would form the bottom contour of the nose section, was constructed of sheetmetal and was hinged at the wing 0.17c station. Its deflection could be varied from 30° to 90° in increments of 10°. Leading-edge droop was provided by deflecting the entire nose section about a hinge point on the lower surface at the 0.17c station. The range of droop angles was from 0° to 30°. For the leading-edge slat, two deflection angles (20° and 30°) and two slot gaps (0.0244c and 0.0122c) were provided. With gaps of 0.0244c and 0.0122c the trailing edges of the slats were 0.0205c and 0.0151c, respectively, above the wing chord. These slat deflections were greater than those normally used on conventional airplanes, and the slat was located in a lower position. These slat deflections and positions were selected on the basis of previous small-scale

tilt-wing tests, but no effort was made to insure that they were near optimum, since it was found that the wing did not stall in the test range and therefore did not benefit from the use of leading-edge flow-control devices.

TESTS, RESULTS, AND CONCLUSIONS

Before the tests were begun it was necessary to determine the nature of the tunnel conditions in which the model would be operating. Extensive surveys at the model location and 20 feet ahead of the model were made with the tunnel empty and at 20 feet ahead of the model with the model installed and operating at a high-lift configuration. It was found that because of the small size of the model in relation to the tunnel size, the model had very little effect on the flow. Dynamic pressure variation was about 1.0 percent and changes in stream angles were less than 0.5°. Consequently, no corrections have been applied to the data.

The tests were run for a range of Fowler flap deflections and a range of settings for the leading-edge flow-control devices. The specific configurations tested, together with a list of tables and figures in which the data for each may be found, are given in the following table:

Leading-edge configuration	Flap deflection, deg	Table	Figure
Basic leading edge	$\delta_f = 0$	1	4
	$\delta_f = 20$	2	5
	$\delta_f = 40$	3	6
	$\delta_f = 50$	4	7
	$\delta_f = 60$	5	8
	$\delta_f = 60$*	6	9
Droop nose: $\delta_n = 20°$	$\delta_f = 40$	7	10
$\delta_n = 30°$	$\delta_f = 40$	8	11
$\delta_n = 10°$	$\delta_f = 50$	9	12
$\delta_n = 20°$	$\delta_f = 50$	10	13
$\delta_n = 30°$	$\delta_f = 50$	11	14
Krueger flap: $\delta_K = 30°$	$\delta_f = 20$	12	15
$\delta_K = 50°$	$\delta_f = 50$	13	16
$\delta_K = 60°$	$\delta_f = 50$	14	17
$\delta_K = 70°$	$\delta_f = 50$	15	18
$\delta_K = 80°$	$\delta_f = 50$	16	19
Leading-edge slat:			
$h/c = 0.012$; $\delta_s = 20°$	$\delta_f = 50$	17	20
$h/c = 0.024$; $\delta_s = 20°$	$\delta_f = 50$	18	21
$h/c = 0.012$; $\delta_s = 30°$	$\delta_f = 50$	19	22
$h/c = 0.024$; $\delta_s = 30°$	$\delta_f = 50$	20	23

*Alternate hinge point.

The tests were made over a range of thrust coefficient from 0 to 1.0, and for any given test the thrust coefficient was held constant over the angle-of-attack range by adjusting the propeller speed to give the required thrust at each angle of attack. The angle-of-attack range for the tests was approximately from the angle required for zero lift to that required to stall the wing or develop a drag-lift ratio of about 0.3, whichever was lower, except for $C_{T,s} = 1.0$ (the static thrust case) where the angle-of-attack range was 0° to 90°.

The data presented have not been analyzed in detail but have been examined to observe the general trends. From this examination, three results are noteworthy. First, the tuft tests showed no stall on the part of the wing immersed in the propeller slipstream at angles of attack well above that corresponding to the peak of the lift curve for the high-thrust conditions corresponding to operation in the STOL range of flight; however, for the low thrust coefficients, the center-section stall correlates with the angle of attack for maximum lift. Second, the wing-flap combination was found to be sufficiently effective to prevent wing stall (judged from tuft-test results) over the entire range of STOL operating conditions covered in the tests, which included the conditions required for descent angles as high as about 20° for each test. Third, the use of leading-edge high-lift, or stall-control devices, was not found to be beneficial in the conditions corresponding to the STOL flight range, evidently because the wing did not stall without such devices.

Langley Research Center,
National Aeronautics and Space Administration,
Langley Station, Hampton, Va., October 18, 1963.

TABLE 1.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 0^\circ$, $\delta_n = 0^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 1.00$		
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.119	-1.034	-0.002
5	.230	-1.025	.003
10	.338	-1.000	-.002
15	.418	-.963	-.003
20	.507	-.919	.001
25	------	------	------
30	.654	-.817	-.007
35	------	------	------
40	.779	-.701	-.019
45	------	------	------
50	.869	-.569	-.030
55	------	------	------
60	.951	-.441	-.047
65	------	------	------
70	1.004	-.265	-.058
75	------	------	------
80	1.040	-.082	-.057
90	1.034	.104	-.062
	$C_{T,s} = 0.95$		
-20	-0.374	-0.928	-0.048
-15	-.253	-.964	-.036
-10	-.115	-.984	-.026
-5	.021	-.991	-.019
0	.167	-.976	-.011
5	.296	-.956	-.007
10	.428	-.916	-.003
15	.540	-.868	-.004
20	.663	-.789	-.008
25	.749	-.727	-.014
30	.827	-.628	-.014
35	.905	-.544	-.018
40	.964	-.454	-.026
45	1.022	-.348	-.030
50	1.060	-.237	-.030
55	1.109	-.108	-.024
60	1.126	.002	-.026
65	1.135	.132	-.023
70	1.140	.250	-.017
75	1.125	.374	-.010
	$C_{T,s} = 0.90$		
-20	-0.434	-0.852	-0.048
-15	-.284	-.905	-.043
-10	-.116	-.933	-.034
-5	.040	-.941	-.026
0	.207	-.924	-.010
5	.363	-.896	-.011
10	.524	-.852	.003
15	.658	-.789	-.002
20	.777	-.690	-.021
25	.882	-.600	-.016
30	.977	-.493	-.035
35	1.061	-.384	-.047
40	1.120	-.265	-.050
45	1.167	-.142	-.057
50	1.180	-.029	-.063
55	1.189	.089	-.074
60	1.191	.200	-.071
65	1.169	.297	-.071
70	1.145	.379	-.059

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.80$		
-20	-0.514	-0.704	-0.057
-15	-.348	-.771	-.067
-10	-.148	-.814	-.056
-5	.042	-.825	-.047
0	.240	-.805	-.040
5	.437	-.769	-.023
10	.644	-.713	-.020
15	.825	-.639	-.020
20	.954	-.530	-.039
25	1.059	-.408	-.059
30	1.173	-.267	-.077
35	1.249	-.123	-.094
40	1.300	.017	-.105
45	1.328	.155	-.113
50	1.339	.276	-.112
55	1.317	.393	-.111
60	1.203	.486	-.101
	$C_{T,s} = 0.60$		
-20	-0.669	-0.448	-0.066
-15	-.475	-.531	-.075
-10	-.229	-.588	-.083
-5	.016	-.596	-.074
0	.284	-.588	-.063
5	.558	-.546	-.058
10	.852	-.464	-.045
15	1.096	-.377	-.053
20	1.215	-.243	-.086
25	1.317	-.107	-.105
30	1.430	.069	-.142
35	1.443	.234	-.164
40	1.481	.379	-.180
45	1.455	.488	-.184
50	1.419	.596	-.189
	$C_{T,s} = 0.30$		
-20	-0.765	-0.070	-0.053
-15	-.611	-.205	-.110
-10	-.306	-.270	-.115
-5	0	-.292	-.097
0	.350	-.273	-.083
5	.700	-.214	-.072
10	1.076	-.122	-.085
15	1.401	-.016	-.100
20	1.516	.152	-.168
25	1.617	.328	-.205
30	1.651	.505	-.259
35	1.598	.667	-.273
40	1.488	.776	-.275
	$C_{T,s} = 0$		
-20	-0.881	0.264	-0.049
-15	-.718	.115	-.128
-10	-.351	.027	-.141
-5	.009	.025	-.115
0	.430	.047	-.099
5	.828	.090	-.092
10	1.289	.194	-.116
15	1.661	.326	-.139
20	1.828	.527	-.222
25	1.976	.712	-.273
30	1.783	.875	-.330
35	1.679	1.031	-.382

TABLE 2.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 20^\circ$, $\delta_n = 0^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 1.00$			
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.310	-0.979	-0.142
5	.404	-.953	-.138
10	.492	-.918	-.138
15	.581	-.869	-.135
20	.650	-.810	-.146
25	------	------	------
30	.773	-.694	-.147
35	------	------	------
40	.863	-.559	-.153
45	------	------	------
50	.927	-.435	-.170
55	------	------	------
60	.991	-.255	-.181
65	------	------	------
70	1.020	-.074	-.176
75	------	------	------
80	1.010	.107	-.183
90	.978	.283	-.185
$C_{T,s} = 0.95$			
-20	-0.101	-0.957	-0.183
-15	.034	-.976	-.184
-10	.173	-.972	-.175
-5	.302	-.958	-.175
0	.437	-.916	-.163
5	.563	-.872	-.169
10	.693	-.805	-.167
15	.789	-.728	-.171
20	.872	-.637	-.166
25	.950	-.549	-.173
30	1.009	-.449	-.170
35	1.054	-.359	-.162
40	1.088	-.258	-.155
45	1.122	-.160	-.151
50	1.136	-.059	-.139
55	1.156	.054	-.136
60	1.157	.146	-.120
65	1.134	.240	-.104
70	1.129	.334	-.079
$C_{T,s} = 0.90$			
-20	-0.132	-0.885	-0.205
-15	.041	-.920	-.221
-10	.205	-.912	-.215
-5	.358	-.892	-.208
0	.526	-.853	-.205
5	.673	-.793	-.201
10	.825	-.718	-.211
15	.943	-.622	-.220
20	1.026	-.514	-.221
25	1.106	-.409	-.221
30	1.180	-.292	-.214
35	1.234	-.180	-.214
40	1.257	-.064	-.213
45	1.264	.046	-.202
50	1.248	.131	-.194
55	1.226	.230	-.178
60	1.203	.302	-.146
65	1.182	.392	-.119

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.80$			
-20	-0.178	-0.762	-0.238
-15	.024	-.799	-.250
-10	.238	-.798	-.256
-5	.432	-.775	-.245
0	.649	-.725	-.246
5	.851	-.654	-.252
10	1.055	-.557	-.260
15	1.213	-.445	-.269
20	1.274	-.316	-.283
25	1.321	-.183	-.282
30	1.390	-.058	-.284
35	1.403	.069	-.270
40	1.410	.194	-.263
45	1.388	.305	-.255
50	1.360	.398	-.233
55	1.315	.476	-.203
$C_{T,s} = 0.60$			
-20	-0.246	-0.496	-0.267
-15	-.019	-.580	-.316
-10	.280	-.572	-.321
-5	.551	-.543	-.320
0	.862	-.487	-.326
5	1.150	-.386	-.346
10	1.450	-.273	-.366
15	1.662	-.135	-.370
20	1.658	.017	-.385
25	1.675	.180	-.381
30	1.630	.321	-.370
35	1.599	.450	-.352
$C_{T,s} = 0.30$			
-20	-0.305	-0.158	-0.276
-15	-.033	-.256	-.365
-10	.354	-.269	-.392
-5	.694	-.223	-.398
0	1.102	-.144	-.421
5	1.494	-.035	-.455
10	1.904	.117	-.479
15	2.182	.289	-.490
20	2.042	.461	-.496
25	2.028	.639	-.532
$C_{T,s} = 0$			
-20	-0.361	0.165	-0.310
-15	-.055	.064	-.432
-10	.423	.064	-.469
-5	.852	.088	-.474
0	1.332	.172	-.499
5	1.829	.298	-.547
10	2.291	.485	-.579
15	2.652	.679	-.596
20	2.498	.888	-.628
25	2.323	1.053	-.632

TABLE 3.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 40^\circ$, $\delta_n = 0^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 1.00$		
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.470	-0.876	-0.254
5	.551	-.825	-.259
10	.633	-.781	-.260
15	.690	-.732	-.260
20	.755	-.670	-.252
25	------	------	------
30	.836	-.548	-.258
35	------	------	------
40	.905	-.421	-.268
45	------	------	------
50	.954	-.268	-.271
55	------	------	------
60	.978	-.077	-.288
65	------	------	------
70	.985	.088	-.289
75	------	------	------
80	.949	.252	-.290
90	.887	.416	-.284
	$C_{T,s} = 0.95$		
-20	0.156	-0.902	-0.348
-15	.283	-.911	-.324
-10	.425	-.881	-.330
-5	.554	-.843	-.330
0	.680	-.781	-.328
5	.798	-.704	-.338
10	.905	-.618	-.345
15	.997	-.522	-.349
20	1.066	-.421	-.347
25	1.113	-.320	-.340
30	1.141	-.226	-.328
35	1.167	-.135	-.318
40	1.176	-.046	-.294
45	1.186	.046	-.276
50	1.174	.124	-.246
55	1.157	.205	-.228
60	1.144	.284	-.201
65	1.125	.367	-.169
	$C_{T,s} = 0.90$		
-20	0.170	-0.850	-0.376
-15	.275	-.861	-.390
-10	.516	-.815	-.391
-5	.659	-.775	-.388
0	.823	-.703	-.398
5	.974	-.605	-.417
10	1.102	-.498	-.416
15	1.191	-.394	-.425
20	1.266	-.265	-.421
25	1.319	-.138	-.419
30	1.352	-.036	-.397
35	1.346	.048	-.364
40	1.344	.144	-.333
45	1.320	.225	-.305
50	1.283	.303	-.272
55	1.235	.365	-.244

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.80$		
-20	0.139	-0.715	-0.404
-15	.400	-.729	-.449
-10	.621	-.689	-.446
-5	.813	-.628	-.453
0	1.035	-.537	-.474
5	1.230	-.431	-.502
10	1.395	-.296	-.510
15	1.522	-.166	-.527
20	1.496	-.047	-.480
25	1.514	.070	-.451
30	1.496	.158	-.417
35	1.467	.246	-.380
40	1.415	.330	-.339
45	1.358	.414	-.314
50	1.319	.487	-.278
	$C_{T,s} = 0.60$		
-20	0.145	-0.484	-0.467
-15	.502	-.492	-.547
-10	.790	-.454	-.544
-5	1.058	-.387	-.554
0	1.379	-.273	-.644
5	1.671	-.128	-.631
10	1.926	.041	-.660
15	2.095	.202	-.662
20	1.911	.303	-.603
25	1.783	.415	-.529
30	1.708	.515	-.488
35	1.602	.589	-.427
	$C_{T,s} = 0.30$		
-20	0.054	-0.124	-0.448
-15	.599	-.175	-.639
-10	.980	-.123	-.665
-5	1.348	-.041	-.694
0	1.780	.098	-.735
5	2.168	.271	-.795
10	2.557	.479	-.821
15	2.761	.680	-.824
20	2.334	.780	-.826
25	2.104	.868	-.664
	$C_{T,s} = 0$		
-20	0.039	0.181	-0.485
-15	.659	.130	-.717
-10	1.182	.188	-.762
-5	1.626	.291	-.810
0	2.139	.446	-.875
5	2.605	.643	-.912
10	3.045	.877	-.959
15	3.189	1.065	-.911
20	2.695	1.195	-.842
25	2.196	1.241	-.734

TABLE 4.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 50^\circ$, $\delta_n = 0^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 1.00$			
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.523	-0.824	-0.311
5	.603	-.793	-.318
10	.671	-.747	-.308
15	.720	-.691	-.308
20	.775	-.626	-.308
25	------	------	------
30	.860	-.506	-.328
35	------	------	------
40	.923	-.357	-.319
45	------	------	------
50	.965	-.200	-.330
55	------	------	------
60	.980	-.012	-.329
65	------	------	------
70	.959	.155	-.335
75	------	------	------
80	.914	.332	-.342
90	.834	.482	-.338
$C_{T,s} = 0.95$			
-20	0.254	-0.887	-0.396
-15	.383	-.866	-.396
-10	.524	-.826	-.403
-5	.652	-.772	-.404
0	.785	-.695	-.423
5	.907	-.606	-.432
10	.999	-.505	-.434
15	1.065	-.416	-.434
20	1.136	-.303	-.440
25	1.172	-.203	-.429
30	1.196	-.102	-.422
35	1.224	.004	-.404
40	1.212	.082	-.372
45	1.195	.143	-.329
50	1.178	.213	-.299
55	1.162	.282	-.256
60	1.137	.341	-.223
$C_{T,s} = 0.90$			
-20	0.313	-0.820	-0.446
-15	.466	-.803	-.452
-10	.632	-.752	-.454
-5	.788	-.687	-.463
0	.944	-.601	-.479
5	1.089	-.494	-.494
10	1.220	-.366	-.513
15	1.295	-.257	-.505
20	1.349	-.130	-.498
25	1.386	-.013	-.485
30	1.391	.087	-.459
35	1.385	.160	-.413
40	1.349	.225	-.363
45	1.305	.286	-.332
50	1.258	.355	-.292
55	1.206	.394	-.244

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.80$			
-20	0.315	-0.691	-0.499
-15	.579	-.672	-.534
-10	.779	-.617	-.533
-5	.976	-.550	-.547
0	1.198	-.431	-.586
5	1.388	-.305	-.607
10	1.556	-.146	-.623
15	1.628	-.029	-.611
20	1.582	.085	-.552
25	1.586	.186	-.522
30	1.544	.261	-.467
35	1.471	.320	-.406
40	1.405	.388	-.365
45	1.355	.462	-.330
$C_{T,s} = 0.60$			
-20	0.378	-0.440	-0.594
-15	.697	-.423	-.630
-10	.956	-.365	-.618
-5	1.215	-.290	-.646
0	1.595	-.146	-.711
5	1.863	.017	-.760
10	2.122	.224	-.795
15	2.267	.389	-.791
20	2.005	.456	-.704
25	1.820	.514	-.594
30	1.695	.587	-.520
$C_{T,s} = 0.30$			
-20	0.339	-0.104	-0.601
-15	.836	-.074	-.744
-10	1.215	-.019	-.774
-5	1.572	.067	-.783
0	2.028	.245	-.901
5	2.455	.449	-.934
10	2.792	.705	-.977
15	2.956	.908	-.980
20	2.375	.910	-.767
$C_{T,s} = 0$			
-20	0.213	0.221	-0.576
-15	.924	.215	-.809
-10	1.442	.297	-.886
-5	1.904	.418	-.938
0	2.415	.615	-1.009
5	2.874	.828	-1.075
10	3.288	1.083	-1.094
15	3.181	1.191	-.961
20	2.692	1.279	-.825

TABLE 5.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 60^\circ$, $\delta_n = 0^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 1.00$			
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.528	-0.790	-0.337
5	.601	-.739	-.345
10	.661	-.680	-.344
15	.721	-.626	-.347
20	.779	-.558	-.351
25	------	------	------
30	.817	-.439	-.346
35	------	------	------
40	.886	-.313	-.346
45	------	------	------
50	.934	-.147	-.361
55	------	------	------
60	.936	.036	-.365
65	------	------	------
70	.925	.183	-.365
75	------	------	------
80	.868	.359	-.377
90	.782	.512	-.365
$C_{T,s} = 0.95$			
-20	0.262	-0.837	-0.407
-15	.367	-.814	-.407
-10	.491	-.774	-.405
-5	.603	-.728	-.404
0	.720	-.661	-.405
5	.845	-.569	-.441
10	.925	-.470	-.430
15	1.049	-.354	-.469
20	1.148	-.211	-.496
25	1.180	-.112	-.493
30	1.221	.010	-.490
35	1.219	.103	-.475
40	1.201	.161	-.430
45	1.186	.225	-.395
50	1.162	.289	-.351
55	1.130	.335	-.304
$C_{T,s} = 0.90$			
-20	0.316	-0.769	-0.480
-15	.420	-.745	-.484
-10	.568	-.699	-.449
-5	.702	-.644	-.443
0	.848	-.569	-.453
5	1.023	-.457	-.498
10	1.178	-.322	-.533
15	1.294	-.181	-.548
20	1.395	-.014	-.572
25	1.413	.097	-.554
30	1.411	.182	-.522
35	1.395	.260	-.478
40	1.352	.311	-.419
45	1.303	.362	-.375
50	1.245	.404	-.324

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.80$			
-20	0.234	-0.629	-0.457
-15	.519	-.600	-.525
-10	.648	-.565	-.494
-5	.855	-.503	-.502
0	1.034	-.417	-.513
5	1.226	-.300	-.553
10	1.403	-.157	-.573
15	1.496	-.030	-.560
20	1.597	.182	-.607
25	1.589	.268	-.558
30	1.555	.356	-.505
35	1.498	.416	-.450
40	1.406	.446	-.385
$C_{T,s} = 0.60$			
-20	0.188	-0.387	-0.486
-15	.620	-.343	-.619
-10	.817	-.301	-.592
-5	1.048	-.238	-.590
0	1.287	-.147	-.586
5	1.540	-.011	-.622
10	1.777	.154	-.648
15	1.904	.278	-.627
20	2.023	.545	-.718
25	1.826	.595	-.611
30	1.734	.681	-.548
$C_{T,s} = 0.30$			
-20	0.167	-0.036	-0.540
-15	.673	.002	-.675
-10	.977	.055	-.706
-5	1.282	.120	-.704
0	1.560	.216	-.666
5	1.842	.346	-.692
10	2.108	.508	-.682
15	2.281	.644	-.644
20	2.418	.806	-.615
25	2.058	.971	-.633
30	1.849	1.067	-.596
$C_{T,s} = 0$			
-20	0.013	0.301	-0.449
-15	.660	.295	-.700
-10	1.093	.375	-.745
-5	1.348	.461	-.740
0	1.696	.546	-.709
5	2.133	.730	-.759
10	2.443	.898	-.746
15	2.693	1.039	-.742
20	2.694	1.205	-.696
25	2.267	1.401	-.730

TABLE 6.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 60^o$, $\delta_n = 0^o$, AND ALTERNATE HINGE POINT

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 1.00$		
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.553	-0.769	-0.280
5	.613	-.729	-.330
10	.675	-.670	-.329
15	.718	-.618	-.327
20	.757	-.563	-.318
25	------	------	------
30	.817	-.448	-.324
35	------	------	------
40	.878	-.312	-.330
45	------	------	------
50	.919	-.152	-.350
55	------	------	------
60	.932	.017	-.329
65	------	------	------
70	.909	.194	-.353
75	------	------	------
80	.855	.355	-.351
90	.769	.478	-.334
	$C_{T,s} = 0.95$		
-20	0.297	-0.837	-0.404
-15	.425	-.814	-.418
-10	.563	-.769	-.423
-5	.669	-.713	-.422
0	.809	-.636	-.449
5	.884	-.557	-.435
10	.990	-.448	-.456
15	1.085	-.335	-.467
20	1.133	-.227	-.469
25	1.176	-.116	-.477
30	1.203	-.008	-.460
35	1.222	.096	-.449
40	1.191	.144	-.402
45	1.176	.205	-.356
50	1.153	.268	-.322
55	1.138	.336	-.289
	$C_{T,s} = 0.90$		
-20	0.358	-0.768	-0.465
-15	.501	-.737	-.466
-10	.656	-.691	-.470
-5	.809	-.620	-.479
0	.973	-.530	-.498
5	1.111	-.422	-.521
10	1.240	-.286	-.540
15	1.341	-.158	-.553
20	1.387	-.030	-.543
25	1.407	.082	-.522
30	1.409	.170	-.495
35	1.373	.234	-.438
40	1.334	.291	-.383
45	1.292	.335	-.341
50	1.238	.386	-.299

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.80$		
-20	0.339	-0.623	-0.502
-15	.617	-.595	-.550
-10	.815	-.546	-.548
-5	1.003	-.468	-.556
0	1.256	-.345	-.607
5	1.463	-.199	-.647
10	1.611	-.049	-.654
15	1.649	.079	-.640
20	1.604	.173	-.576
25	1.606	.279	-.542
30	1.558	.331	-.486
35	1.476	.387	-.412
40	1.382	.430	-.354
	$C_{T,s} = 0.60$		
-20	0.394	-0.373	-0.580
-15	.764	-.338	-.644
-10	1.010	-.286	-.641
-5	1.274	-.216	-.654
0	1.622	-.059	-.712
5	1.903	.115	-.792
10	2.128	.313	-.807
15	2.304	.501	-.829
20	1.995	.538	-.684
25	1.803	.590	-.560
	$C_{T,s} = 0.30$		
-20	0.321	-0.047	-0.584
-15	.952	.009	-.773
-10	1.305	.062	-.795
-5	1.606	.139	-.777
0	2.033	.322	-.858
5	2.451	.543	-.945
10	2.783	.778	-.967
15	3.055	1.034	-1.024
20	2.478	1.017	-.786
25	2.010	1.016	-.659
	$C_{T,s} = 0$		
-20	0.168	0.306	-0.515
-15	1.032	.289	-.841
-10	1.505	.386	-.879
-5	1.944	.512	-.926
0	2.480	.719	-1.003
5	2.909	.931	-1.070
10	3.272	1.181	-1.121
15	3.490	1.402	-1.085
20	2.688	1.396	-.868
25	2.110	1.420	-.781

TABLE 7.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 40^\circ$, $\delta_n = 20^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 1.00$		
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.449	-0.869	-0.249
5	.513	-.838	-.251
10	.580	-.789	-.252
15	.660	-.732	-.256
20	.719	-.676	-.272
25	------	------	------
30	.806	-.561	-.253
35	------	------	------
40	.863	-.430	-.263
45	------	------	------
50	.899	-.300	-.264
55	------	------	------
60	.931	-.121	-.268
65	------	------	------
70	.956	.053	-.271
75	------	------	------
80	.932	.226	-.285
90	.873	.391	-.276
	$C_{T,s} = 0.95$		
-20	0.045	-0.888	-0.278
-15	.180	-.886	-.286
-10	.337	-.871	-.297
-5	.486	-.835	-.318
0	.642	-.777	-.334
5	.766	-.710	-.349
10	.888	-.616	-.365
15	.974	-.519	-.368
20	1.053	-.437	-.369
25	1.103	-.326	-.363
30	1.125	-.240	-.350
35	1.163	-.130	-.346
40	1.179	-.027	-.333
45	1.191	.070	-.310
50	1.174	.141	-.273
55	1.159	.212	-.245
60	1.157	.292	-.192
65	1.126	.357	-.177
	$C_{T,s} = 0.90$		
-20	0.032	-0.819	-0.293
-15	.214	-.827	-.315
-10	.415	-.810	-.336
-5	.612	-.766	-.375
0	.797	-.701	-.391
5	.949	-.609	-.416
10	1.105	-.491	-.433
15	1.202	-.388	-.442
20	1.294	-.250	-.448
25	1.316	-.140	-.425
30	1.343	-.033	-.415
35	1.363	.084	-.394
40	1.342	.171	-.361
45	1.320	.249	-.332
50	1.278	.316	-.295
55	1.222	.370	-.253
60	1.186	.405	-.193

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.80$		
-20	0.016	-0.673	-0.324
-15	.193	-.692	-.314
-10	.449	-.689	-.372
-5	.771	-.632	-.450
0	1.026	-.541	-.486
5	1.226	-.429	-.515
10	1.406	-.291	-.527
15	1.552	-.152	-.535
20	1.625	-.020	-.525
25	1.565	.088	-.497
30	1.583	.210	-.466
35	1.523	.287	-.402
40	1.453	.369	-.359
45	1.392	.444	-.333
	$C_{T,s} = 0.60$		
-20	0.017	-0.401	-0.251
-15	.166	-.441	-.359
-10	.544	-.444	-.435
-5	1.012	-.374	-.560
0	1.361	-.273	-.605
5	1.674	-.118	-.649
10	1.935	.055	-.680
15	2.096	.226	-.679
20	1.916	.312	-.596
25	1.847	.424	-.553
30	1.817	.545	-.508
35	1.731	.645	-.464
	$C_{T,s} = 0.30$		
-20	-0.042	-0.073	-0.342
-15	.204	-.111	-.392
-10	.617	-.117	-.494
-5	1.296	-.044	-.700
0	1.753	.100	-.764
5	2.140	.275	-.818
10	2.499	.483	-.832
15	2.697	.671	-.825
20	2.052	.714	-.686
25	2.022	.821	-.617
	$C_{T,s} = 0$		
-20	-0.177	0.280	-0.225
-15	.099	.204	-.321
-10	.760	.202	-.580
-5	1.599	.288	-.832
0	2.128	.450	-.903
5	2.603	.649	-.951
10	2.994	.887	-.976
15	2.730	.978	-.833
20	1.898	1.022	-.731

TABLE 8.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 40^\circ$, $\delta_n = 30^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 1.00$			
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.452	-0.872	-0.243
5	.519	-.830	-.241
10	.570	-.787	-.238
15	.625	-.739	-.227
20	.676	-.696	-.221
25	------	------	------
30	.764	-.584	-.208
35	------	------	------
40	.819	-.457	-.228
45	------	------	------
50	.869	-.315	-.223
55	------	------	------
60	.910	-.152	-.240
65	------	------	------
70	.939	.010	-.239
75	------	------	------
80	.915	.178	-.235
90	.864	.347	-.234
$C_{T,s} = 0.95$			
-20	0.002	-0.870	-0.239
-15	.137	-.879	-.245
-10	.309	-.863	-.279
-5	.445	-.835	-.288
0	.599	-.777	-.313
5	.729	-.711	-.324
10	.872	-.612	-.356
15	.951	-.543	-.347
20	1.024	-.434	-.356
25	1.086	-.332	-.357
30	1.121	-.238	-.352
35	1.151	-.133	-.341
40	1.174	-.020	-.338
45	1.174	.065	-.307
50	1.172	.143	-.279
55	1.156	.212	-.240
60	1.144	.293	-.213
65	1.124	.345	-.161
$C_{T,s} = 0.90$			
-20	-0.014	-0.781	-0.254
-15	.152	-.815	-.267
-10	.374	-.799	-.308
-5	.550	-.759	-.344
0	.753	-.694	-.372
5	.928	-.607	-.401
10	1.069	-.500	-.422
15	1.187	-.388	-.430
20	1.301	-.251	-.444
25	1.313	-.151	-.427
30	1.338	-.031	-.418
35	1.357	.074	-.397
40	1.346	.171	-.373
45	1.320	.256	-.340
50	1.267	.308	-.302
55	1.220	.352	-.243
60	1.187	.401	-.203

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.80$			
-20	-0.039	-0.652	-0.280
-15	.123	-.680	-.282
-10	.351	-.675	-.317
-5	.661	-.642	-.390
0	.980	-.545	-.462
5	1.204	-.433	-.509
10	1.399	-.294	-.528
15	1.549	-.155	-.538
20	1.594	-.021	-.520
25	1.553	.084	-.497
30	1.597	.215	-.472
35	1.553	.308	-.435
40	1.493	.397	-.373
45	1.419	.450	-.337
$C_{T,s} = 0.60$			
-20	-0.071	-0.388	-0.292
-15	.132	-.425	-.324
-10	.392	-.433	-.356
-5	.847	-.390	-.473
0	1.342	-.269	-.604
5	1.666	-.127	-.651
10	1.931	.050	-.684
15	2.109	.216	-.681
20	1.874	.302	-.599
25	1.827	.416	-.542
30	1.799	.537	-.506
35	1.738	.641	-.462
$C_{T,s} = 0.30$			
-20	-0.127	-0.051	-0.239
-15	.069	-.099	-.269
-10	.435	-.106	-.379
-5	1.062	-.052	-.579
0	1.723	.088	-.752
5	2.158	.274	-.821
10	2.487	.488	-.838
15	2.663	.652	-.798
20	2.001	.689	-.661
$C_{T,s} = 0$			
-20	-0.196	0.296	-0.177
-15	.018	.216	-.227
-10	.399	.200	-.353
-5	1.267	.273	-.679
0	2.100	.451	-.901
5	2.592	.647	-.959
10	3.004	.875	-.985
15	2.710	.965	-.835
20	1.895	1.030	-.736

TABLE 9.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 50^\circ$, $\delta_n = 10^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 1.00$		
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.519	-0.817	-0.305
5	.591	-.786	-.308
10	.656	-.718	-.310
15	.709	-.676	-.304
20	.763	-.608	-.307
25	------	------	------
30	.836	-.491	-.314
35	------	------	------
40	.884	-.369	-.317
45	------	------	------
50	.920	-.226	-.322
55	------	------	------
60	.950	-.025	-.330
65	------	------	------
70	.939	.143	-.332
75	------	------	------
80	.893	.321	-.339
90	.825	.472	-.328
	$C_{T,s} = 0.95$		
-20	0.191	-0.879	-0.360
-15	.343	-.880	-.382
-10	.502	-.828	-.397
-5	.638	-.772	-.409
0	.781	-.697	-.434
5	.892	-.604	-.446
10	.978	-.514	-.437
15	1.049	-.420	-.447
20	1.117	-.312	-.444
25	1.156	-.214	-.442
30	1.187	-.104	-.430
35	1.202	-.010	-.419
40	1.208	.093	-.396
45	1.198	.158	-.351
50	1.174	.223	-.311
55	1.155	.294	-.271
60	1.137	.343	-.244
	$C_{T,s} = 0.90$		
-20	0.197	-0.808	-0.389
-15	.413	-.798	-.425
-10	.608	-.751	-.451
-5	.769	-.688	-.464
0	.929	-.604	-.486
5	1.081	-.492	-.507
10	1.216	-.365	-.532
15	1.307	-.247	-.533
20	1.350	-.124	-.512
25	1.381	-.010	-.507
30	1.400	.102	-.480
35	1.382	.176	-.436
40	1.357	.246	-.391
45	1.319	.315	-.352
50	1.255	.361	-.306
55	1.212	.409	-.258

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.80$		
-20	0.147	-0.665	-0.404
-15	.403	-.668	-.446
-10	.749	-.622	-.528
-5	.968	-.545	-.576
0	1.197	-.434	-.592
5	1.392	-.301	-.616
10	1.560	-.137	-.633
15	1.685	.003	-.638
20	1.692	.118	-.609
25	1.607	.201	-.543
30	1.555	.274	-.474
35	1.498	.343	-.409
40	1.416	.402	-.364
45	1.347	.476	-.332
	$C_{T,s} = 0.60$		
-20	0.121	-0.400	-0.433
-15	.548	-.419	-.566
-10	.918	-.360	-.627
-5	1.203	-.291	-.692
0	1.599	-.139	-.731
5	1.899	.027	-.782
10	2.135	.235	-.810
15	2.338	.411	-.741
20	2.011	.448	-.678
25	1.958	.554	-.585
30	1.775	.620	-.541
	$C_{T,s} = 0.30$		
-20	0.090	-0.066	-0.440
-15	.448	-.088	-.537
-10	1.197	-.030	-.779
-5	1.552	.062	-.799
0	2.036	.232	-.882
5	2.437	.447	-.952
10	2.768	.689	-.969
15	2.952	.886	-.965
20	2.159	.850	-.723
25	2.118	.976	-.673
	$C_{T,s} = 0$		
-20	0.097	0.287	-0.440
-15	.541	.235	-.612
-10	1.411	.286	-.888
-5	1.890	.417	-.958
0	2.414	.617	-1.031
5	2.893	.837	-1.086
10	3.307	1.091	-1.127
15	2.887	1.133	-.941
20	2.023	1.140	-.781

TABLE 10.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 50^\circ$, $\delta_n = 20^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 1.00$		
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.474	-0.829	-0.277
5	.536	-.793	-.283
10	.632	-.730	-.287
15	.669	-.676	-.277
20	.716	-.626	-.277
25	------	------	------
30	.796	-.512	-.277
35	------	------	------
40	.873	-.375	-.281
45	------	------	------
50	.914	-.221	-.299
55	------	------	------
60	.946	-.047	-.294
65	------	------	------
70	.944	.132	-.308
75	------	------	------
80	.891	.268	-.310
90	.831	.424	-.295
	$C_{T,s} = 0.95$		
-20	0.123	-0.853	-0.315
-15	.245	-.845	-.319
-10	.397	-.822	-.332
-5	.552	-.775	-.359
0	.715	-.701	-.387
5	.859	-.610	-.428
10	.973	-.505	-.437
15	1.042	-.416	-.439
20	1.102	-.308	-.438
25	1.144	-.210	-.438
30	1.176	-.109	-.432
35	1.186	-.008	-.413
40	1.193	.085	-.402
45	1.179	.147	-.355
50	1.161	.198	-.313
55	1.150	.271	-.266
60	1.130	.336	-.234
	$C_{T,s} = 0.90$		
-20	0.121	-0.785	-0.333
-15	.302	-.786	-.358
-10	.491	-.763	-.385
-5	.702	-.699	-.426
0	.912	-.603	-.483
5	1.063	-.496	-.499
10	1.187	-.372	-.558
15	1.315	-.246	-.542
20	1.363	-.123	-.525
25	1.382	-.007	-.504
30	1.390	.097	-.488
35	1.390	.188	-.445
40	1.357	.254	-.405
45	1.326	.325	-.362
50	1.257	.353	-.308
55	1.199	.393	-.259

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.80$		
-20	0.082	-0.642	-0.350
-15	.267	-.660	-.371
-10	.552	-.636	-.415
-5	.914	-.551	-.527
0	1.185	-.423	-.590
5	1.381	-.297	-.617
10	1.557	-.142	-.638
15	1.680	-.004	-.639
20	1.694	.127	-.607
25	1.626	.213	-.566
30	1.607	.314	-.510
35	1.525	.374	-.437
40	1.441	.428	-.382
45	1.362	.472	-.336
	$C_{T,s} = 0.60$		
-20	0.052	-0.366	-0.372
-15	.286	-.411	-.420
-10	.764	-.373	-.545
-5	1.210	-.295	-.656
0	1.580	-.149	-.732
5	1.892	.022	-.790
10	2.141	.229	-.814
15	2.281	.404	-.810
20	1.986	.432	-.672
25	1.889	.520	-.602
30	1.829	.631	-.556
	$C_{T,s} = 0.30$		
-20	0.040	-0.044	-0.392
-15	.316	-.074	-.454
-10	.906	-.050	-.637
-5	1.553	.060	-.798
0	2.012	.215	-.880
5	2.427	.440	-.955
10	2.765	.686	-.974
15	2.931	.868	-.954
20	2.146	.822	-.727
25	2.045	.915	-.658
	$C_{T,s} = 0$		
-20	-0.136	0.277	-0.263
-15	.228	.227	-.422
-10	1.056	.263	-.709
-5	1.888	.406	-.968
0	2.467	.593	-1.052
5	2.899	.831	-1.101
10	3.299	1.090	-1.131
15	2.695	1.105	-.927
20	1.964	1.123	-.784

TABLE 11.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 50°$, $\delta_n = 30°$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 1.00$		
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.427	-0.836	-0.248
5	.519	-.781	-.259
10	.582	-.736	-.254
15	.634	-.688	-.247
20	.689	-.638	-.246
25	------	------	------
30	.777	-.526	-.234
35	------	------	------
40	.832	-.398	-.245
45	------	------	------
50	.885	-.259	-.254
55	------	------	------
60	.923	-.090	-.262
65	------	------	------
70	.922	.067	-.263
75	------	------	------
80	.889	.219	-.265
90	.831	.382	-.268
	$C_{T,s} = 0.95$		
-20	0.053	-0.832	-0.255
-15	.202	-.838	-.280
-10	.378	-.820	-.310
-5	.509	-.784	-.320
0	.663	-.715	-.345
5	.806	-.632	-.378
10	.947	-.525	-.402
15	1.041	-.412	-.427
20	1.100	-.311	-.431
25	1.132	-.219	-.421
30	1.165	-.116	-.407
35	1.178	-.025	-.393
40	1.183	.074	-.374
45	1.173	.144	-.341
50	1.161	.203	-.299
55	1.142	.266	-.260
60	1.116	.323	-.226
	$C_{T,s} = 0.90$		
-20	0.042	-0.762	-0.284
-15	.205	-.776	-.301
-10	.435	-.754	-.343
-5	.629	-.701	-.376
0	.842	-.620	-.427
5	1.033	-.502	-.471
10	1.185	-.378	-.511
15	1.288	-.258	-.518
20	1.368	-.114	-.526
25	1.374	-.012	-.506
30	1.387	.092	-.481
35	1.381	.184	-.452
40	1.361	.267	-.406
45	1.320	.308	-.344
50	1.262	.356	-.293
55	1.199	.385	-.251

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.80$		
-20	0.031	-0.609	-0.321
-15	.191	-.631	-.332
-10	.443	-.625	-.360
-5	.759	-.570	-.447
0	1.102	-.447	-.543
5	1.354	-.302	-.602
10	1.535	-.145	-.634
15	1.681	.008	-.638
20	1.617	.103	-.601
25	1.612	.218	-.564
30	1.621	.332	-.531
35	1.555	.403	-.462
40	1.459	.448	-.396
	$C_{T,s} = 0.60$		
-20	-0.038	-0.368	-0.302
-15	.215	-.398	-.362
-10	.522	-.394	-.416
-5	1.019	-.315	-.561
0	1.530	-.156	-.706
5	1.860	.015	-.774
10	2.119	.223	-.804
15	2.275	.397	-.806
20	1.927	.416	-.660
25	1.844	.523	-.591
30	1.802	.633	-.551
	$C_{T,s} = 0.30$		
-20	-0.110	-0.034	-0.208
-15	.128	-.069	-.286
-10	.581	-.050	-.439
-5	1.325	.040	-.703
0	1.968	.225	-.861
5	2.422	.439	-.963
10	2.782	.677	-.984
15	2.951	.869	-.980
20	2.051	.792	-.681
25	1.787	.828	-.661
	$C_{T,s} = 0$		
-20	-0.180	0.303	-0.181
-15	.029	.253	-.209
-10	.542	.250	-.419
-5	1.527	.365	-.795
0	2.373	.602	-1.023
5	2.886	.834	-1.098
10	3.279	1.076	-1.121
15	2.824	1.106	-.901
20	1.903	1.143	-.783

TABLE 12.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 20^\circ$, $\delta_K = 30^\circ$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 1.00$		
-20	------	------	------
-15	------	------	------
-10	------	------	------
-5	------	------	------
0	0.245	-0.921	-0.120
5	.346	-.908	-.130
10	.437	-.872	-.123
15	.511	-.830	-.122
20	.580	-.785	-.122
25	------	------	------
30	.698	-.678	-.126
35	------	------	------
40	.786	-.563	-.122
45	------	------	------
50	.845	-.435	-.151
55	------	------	------
60	.898	-.280	-.162
65	------	------	------
70	.940	-.109	-.167
75	------	------	------
80	.953	.050	-.156
90	.925	.235	-.164
	$C_{T,s} = 0.95$		
-20	-0.205	-0.856	-0.148
-15	-.081	-.881	-.147
-10	.066	-.886	-.156
-5	.199	-.881	-.149
0	.346	-.856	-.153
5	.474	-.818	-.153
10	.610	-.765	-.165
15	.717	-.696	-.170
20	.824	-.619	-.168
25	.915	-.529	-.175
30	.964	-.448	-.178
35	1.008	-.358	-.170
40	1.043	-.266	-.162
45	1.078	-.167	-.151
50	1.110	-.069	-.133
55	1.120	.030	-.126
60	1.173	.193	-.113
65	1.164	.316	-.114
70	1.154	.407	-.082
75	1.126	.484	-.051
	$C_{T,s} = 0.90$		
-20	-0.238	-0.754	-0.160
-15	-.100	-.796	-.165
-10	.076	-.817	-.172
-5	.250	-.820	-.180
0	.431	-.795	-.178
5	.580	-.749	-.178
10	.753	-.681	-.186
15	.900	-.597	-.197
20	1.031	-.489	-.212
25	1.113	-.385	-.209
30	1.169	-.279	-.205
35	1.193	-.172	-.200
40	1.220	-.060	-.195
45	1.221	.040	-.183
50	1.207	.134	-.179
55	1.203	.244	-.165
60	1.182	.316	-.145
65	1.150	.399	-.123

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.80$		
-20	-0.259	-0.616	-0.156
-15	-.118	-.659	-.165
-10	.055	-.689	-.173
-5	.268	-.697	-.205
0	.526	-.674	-.223
5	.772	-.613	-.241
10	.997	-.528	-.258
15	1.171	-.425	-.262
20	1.257	-.304	-.273
25	1.362	-.169	-.267
30	1.428	-.026	-.266
35	1.463	.108	-.260
40	1.430	.224	-.249
45	1.402	.326	-.225
50	1.383	.423	-.203
55	1.337	.523	-.178
	$C_{T,s} = 0.60$		
-20	-0.257	-0.367	-0.182
-15	-.113	-.419	-.183
-10	.073	-.466	-.191
-5	.268	-.479	-.205
0	.676	-.454	-.289
5	1.044	-.379	-.329
10	1.408	-.253	-.368
15	1.628	-.118	-.368
20	1.665	.019	-.365
25	1.707	.170	-.353
30	1.734	.343	-.340
35	1.704	.478	-.323
40	1.642	.587	-.295
	$C_{T,s} = 0.30$		
-20	-0.221	-0.026	-0.198
-15	-.101	-.091	-.185
-10	.093	-.147	-.188
-5	.293	-.165	-.215
0	.812	-.122	-.337
5	1.369	-.033	-.438
10	1.715	.122	-.455
15	2.111	.288	-.456
20	2.069	.464	-.454
25	2.093	.639	-.459
30	2.042	.809	-.474
	$C_{T,s} = 0$		
-20	-0.213	0.342	-0.184
-15	-.095	.257	-.175
-10	.092	.194	-.190
-5	.320	.145	-.216
0	.905	.181	-.367
5	1.657	.304	-.527
10	2.203	.488	-.568
15	2.589	.676	-.554
20	2.349	.845	-.535
25	2.366	1.050	-.554

TABLE 13.- TABULATED AERODYNAMIC DATA

FOR $\delta_f = 50°$, $\delta_K = 50°$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.90$			
-20	-0.077	-0.711	-0.231
-15	.083	-.723	-.250
-10	.276	-.721	-.279
-5	.450	-.693	-.291
0	.596	-.650	-.303
5	.751	-.580	-.313
10	.907	-.484	-.342
15	1.054	-.371	-.364
20	1.186	-.229	-.410
25	1.250	-.101	-.421
30	1.291	.011	-.413
35	1.294	.103	-.396
40	1.281	.180	-.357
45	1.257	.253	-.317
50	1.182	.282	-.263
55	1.155	.341	-.235
60	1.128	.377	-.198
$C_{T,s} = 0.80$			
-20	-0.155	-0.576	-0.203
-15	.025	-.605	-.234
-10	.261	-.603	-.288
-5	.508	-.566	-.336
0	.802	-.498	-.380
5	1.000	-.408	-.402
10	1.209	-.288	-.437
15	1.410	-.132	-.475
20	1.571	.032	-.503
25	1.578	.172	-.500
30	1.609	.303	-.474
35	1.591	.402	-.435
40	1.500	.477	-.394
$C_{T,s} = 0.60$			
-20	-0.172	-0.318	-0.210
-15	-.008	-.363	-.227
-10	.245	-.381	-.274
-5	.544	-.340	-.346
0	1.053	-.244	-.471
5	1.461	-.107	-.518
10	1.825	.077	-.646
15	2.072	.279	-.687
20	2.292	.515	-.705
25	1.973	.552	-.619
30	1.917	.683	-.563

TABLE 14.- TABULATED AERODYNAMIC DATA

FOR $\delta_f = 50°$, $\delta_K = 60°$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.90$			
-20	-0.097	-0.713	-0.203
-15	.068	-.741	-.229
-10	.264	-.716	-.261
-5	.421	-.693	-.275
0	.587	-.638	-.300
5	.727	-.579	-.300
10	.882	-.489	-.321
15	.983	-.403	-.330
20	1.116	-.270	-.361
25	1.171	-.143	-.421
30	1.254	-.016	-.390
35	1.261	.081	-.373
40	1.230	.161	-.343
45	1.202	.225	-.301
50	1.160	.278	-.269
55	1.135	.324	-.227
$C_{T,s} = 0.80$			
-20	-0.153	-0.578	-0.187
-15	.015	-.605	-.222
-10	.246	-.598	-.260
-5	.492	-.563	-.314
0	.767	-.496	-.357
5	.975	-.419	-.377
10	1.174	-.300	-.408
15	1.365	-.155	-.446
20	1.529	.013	-.479
25	1.588	.154	-.485
30	1.572	.271	-.459
35	1.554	.380	-.425
40	1.462	.450	-.384
$C_{T,s} = 0.60$			
-20	-0.167	-0.314	-0.196
-15	-.030	-.362	-.193
-10	.213	-.383	-.235
-5	.508	-.339	-.311
0	.977	-.247	-.433
5	1.399	-.119	-.525
10	1.765	.062	-.599
15	2.021	.257	-.656
20	2.247	.475	-.670
25	1.867	.522	-.583
30	1.809	.630	-.532

TABLE 15.- TABULATED AERODYNAMIC DATA

FOR $\delta_f = 50°$, $\delta_K = 70°$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.90$			
-20	-0.104	-0.707	-0.178
-15	.053	-.723	-.204
-10	.262	-.714	-.257
-5	.405	-.690	-.259
0	.589	-.638	-.282
5	.716	-.584	-.285
10	.857	-.497	-.296
15	.977	-.407	-.319
20	1.086	-.295	-.325
25	1.161	-.172	-.342
30	1.210	-.053	-.351
35	1.223	.045	-.337
40	1.215	.132	-.313
45	1.185	.195	-.278
50	1.155	.254	-.245
55	1.135	.318	-.218
$C_{T,s} = 0.80$			
-20	-0.151	-0.584	-0.172
-15	.004	-.612	-.193
-10	.224	-.602	-.239
-5	.469	-.564	-.298
0	.731	-.504	-.337
5	.956	-.423	-.363
10	1.156	-.309	-.400
15	1.328	-.181	-.425
20	1.496	-.005	-.461
25	1.532	.131	-.469
30	1.534	.250	-.454
35	1.518	.342	-.400
40	1.457	.434	-.376
45	1.395	.505	-.348
$C_{T,s} = 0.60$			
-20	-0.157	-0.321	-0.183
-15	-.031	-.368	-.176
-10	.180	-.388	-.200
-5	.490	-.346	-.280
0	.933	-.248	-.405
5	1.367	-.122	-.511
10	1.705	.052	-.576
15	1.960	.228	-.622
20	2.175	.441	-.653
25	1.862	.523	-.584
30	1.777	.644	-.550
35	1.706	.723	-.480

TABLE 16.- TABULATED AERODYNAMIC DATA

FOR $\delta_f = 50°$, $\delta_K = 80°$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.90$			
-20	-0.110	-0.715	-0.171
-15	.047	-.727	-.192
-10	.229	-.721	-.222
-5	.414	-.684	-.254
0	.576	-.634	-.272
5	.729	-.571	-.282
10	.856	-.497	-.291
15	.964	-.406	-.300
20	1.065	-.291	-.315
25	1.133	-.187	-.325
30	1.188	-.066	-.332
35	1.208	.033	-.323
40	1.194	.107	-.291
45	1.167	.178	-.270
50	1.146	.248	-.247
55	1.127	.314	-.209
60	1.098	.368	-.181
$C_{T,s} = 0.80$			
-20	-0.152	-0.584	-0.159
-15	.006	-.612	-.173
-10	.222	-.611	-.219
-5	.453	-.566	-.275
0	.720	-.496	-.323
5	.960	-.414	-.356
10	1.140	-.313	-.372
15	1.300	-.188	-.409
20	1.442	-.031	-.434
25	1.469	.122	-.454
30	1.491	.241	-.439
35	1.477	.344	-.407
40	1.446	.434	-.376
45	1.401	.503	-.332
$C_{T,s} = 0.60$			
-20	-0.147	-0.326	-0.157
-15	-.026	-.375	-.160
-10	.137	-.397	-.154
-5	.472	-.365	-.270
0	.901	-.257	-.388
5	1.364	-.121	-.496
10	1.684	.042	-.551
15	1.941	.212	-.606
20	2.119	.405	-.623
25	1.806	.498	-.563
30	1.763	.618	-.528

TABLE 17.- TABULATED AERODYNAMIC DATA FOR

$\delta_f = 50^\circ$, $\delta_s = 20^\circ$, $\frac{h}{c} = 0.012$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.90$		
-20	-0.046	-0.735	-0.257
-15	.122	-.756	-.273
-10	.314	-.744	-.295
-5	.481	-.709	-.322
0	.642	-.646	-.338
5	.810	-.560	-.364
10	.999	-.433	-.420
15	1.137	-.311	-.442
20	1.255	-.178	-.459
25	1.319	-.043	-.463
30	1.333	.067	-.448
35	1.312	.138	-.408
40	1.279	.211	-.371
45	1.250	.270	-.326
50	1.189	.308	-.274
55	1.150	.361	-.243
	$C_{T,s} = 0.80$		
-20	-0.096	-0.603	-0.260
-15	.079	-.625	-.281
-10	.311	-.621	-.317
-5	.553	-.584	-.366
0	.840	-.503	-.411
5	1.092	-.387	-.456
10	1.319	-.232	-.510
15	1.509	-.079	-.547
20	1.673	.110	-.569
25	1.670	.222	-.547
30	1.593	.289	-.486
35	1.517	.365	-.423
40	1.475	.450	-.373
	$C_{T,s} = 0.60$		
-20	-0.130	-0.324	-0.268
-15	.038	-.370	-.283
-10	.286	-.390	-.320
-5	.617	-.342	-.387
0	1.147	-.233	-.522
5	1.558	-.069	-.616
10	1.950	.175	-.734
15	2.170	.376	-.764
20	2.294	.555	-.728
25	2.222	.618	-.603
30	1.964	.602	-.475
35	1.865	.674	-.431

TABLE 18.- TABULATED AERODYNAMIC DATA FOR

$\delta_f = 50^\circ$, $\delta_s = 20^\circ$, $\frac{h}{c} = 0.024$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
	$C_{T,s} = 0.90$		
-20	-0.060	-0.733	-0.256
-15	.103	-.755	-.274
-10	.311	-.743	-.302
-5	.480	-.707	-.325
0	.677	-.636	-.349
5	.842	-.544	-.390
10	1.016	-.425	-.421
15	1.145	-.307	-.449
20	1.258	-.174	-.459
25	1.329	-.041	-.464
30	1.316	.054	-.451
35	1.329	.151	-.418
40	1.293	.205	-.364
45	1.259	.272	-.323
50	1.195	.304	-.312
55	1.156	.371	-.254
	$C_{T,s} = 0.80$		
-20	-0.110	-0.596	-0.265
-15	.072	-.629	-.284
-10	.300	-.626	-.320
-5	.552	-.585	-.364
0	.832	-.505	-.412
5	1.104	-.385	-.471
10	1.344	-.227	-.524
15	1.543	-.064	-.565
20	1.685	.121	-.586
25	1.747	.253	-.570
30	1.651	.306	-.490
35	1.523	.313	-.380
40	1.493	.458	-.389
	$C_{T,s} = 0.60$		
-20	-0.139	-0.328	-0.267
-15	.029	-.382	-.282
-10	.282	-.385	-.321
-5	.624	-.341	-.382
0	1.159	-.228	-.530
5	1.608	-.050	-.650
10	1.979	.186	-.743
15	2.169	.367	-.750
20	2.298	.554	-.723
25	2.291	.643	-.627
30	2.169	.668	-.511
35	1.924	.655	-.405

TABLE 19.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 50°$, $\delta_s = 30°$, $\frac{h}{c} = 0.012$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.90$			
-20	-0.059	-0.723	-0.240
-15	.103	-.742	-.261
-10	.295	-.730	-.290
-5	.464	-.702	-.306
0	.640	-.644	-.326
5	.786	-.563	-.351
10	.951	-.459	-.380
15	1.107	-.323	-.434
20	1.231	-.191	-.452
25	1.324	-.053	-.461
30	1.335	.056	-.453
35	1.322	.142	-.421
40	1.281	.203	-.378
45	1.233	.257	-.332
50	1.176	.296	-.280
55	1.133	.351	-.255
60	1.114	.400	-.212
$C_{T,s} = 0.80$			
-20	-0.094	-0.589	-0.252
-15	.066	-.612	-.267
-10	.290	-.610	-.305
-5	.532	-.575	-.347
0	.811	-.499	-.394
5	1.057	-.395	-.461
10	1.304	-.237	-.510
15	1.484	-.088	-.545
20	1.657	.095	-.565
25	1.686	.224	-.562
30	1.607	.298	-.489
35	1.554	.366	-.435
40	1.479	.456	-.397
45	1.425	.518	-.353
$C_{T,s} = 0.60$			
-20	-0.146	-0.315	-0.244
-15	.035	-.360	-.265
-10	.267	-.370	-.302
-5	.569	-.343	-.359
0	1.069	-.239	-.487
5	1.539	-.068	-.617
10	1.945	.157	-.732
15	2.134	.341	-.748
20	2.297	.544	-.734
25	2.306	.658	-.654
30	2.072	.630	-.497
35	1.871	.654	-.407

TABLE 20.- TABULATED AERODYNAMIC DATA FOR $\delta_f = 50°$, $\delta_s = 30°$, $\frac{h}{c} = 0.024$

α, deg	$C_{L,s}$	$C_{D,s}$	$C_{m,s}$
$C_{T,s} = 0.90$			
-20	-0.061	-0.720	-0.250
-15	.107	-.740	-.273
-10	.296	-.727	-.294
-5	.470	-.699	-.311
0	.638	-.638	-.339
5	.809	-.555	-.366
10	.984	-.439	-.400
15	1.125	-.318	-.440
20	1.243	-.179	-.449
25	1.359	-.023	-.481
30	1.310	.038	-.446
35	1.336	.150	-.432
40	1.291	.217	-.384
45	1.249	.258	-.329
50	1.180	.292	-.284
55	1.139	.345	-.257
60	1.116	.409	-.230
$C_{T,s} = 0.80$			
-20	-0.118	-0.587	-0.301
-15	.059	-.619	-.267
-10	.292	-.616	-.316
-5	.530	-.579	-.348
0	.811	-.498	-.403
5	1.075	-.385	-.455
10	1.320	-.233	-.519
15	1.518	-.068	-.563
20	1.680	.118	-.592
25	1.731	.238	-.562
30	1.637	.291	-.486
35	1.568	.332	-.391
40	1.465	.410	-.382
45	1.423	.509	-.338
$C_{T,s} = 0.60$			
-20	-0.188	-0.358	-0.261
-15	.082	-.402	-.287
-10	.306	-.420	-.318
-5	.625	-.382	-.380
0	1.209	-.274	-.541
5	1.659	-.082	-.674
10	2.007	.228	-.764
15	2.217	.421	-.785
20	2.331	.585	-.743
25	2.331	.688	-.659
30	2.210	.703	-.454
35	1.951	.670	-.379

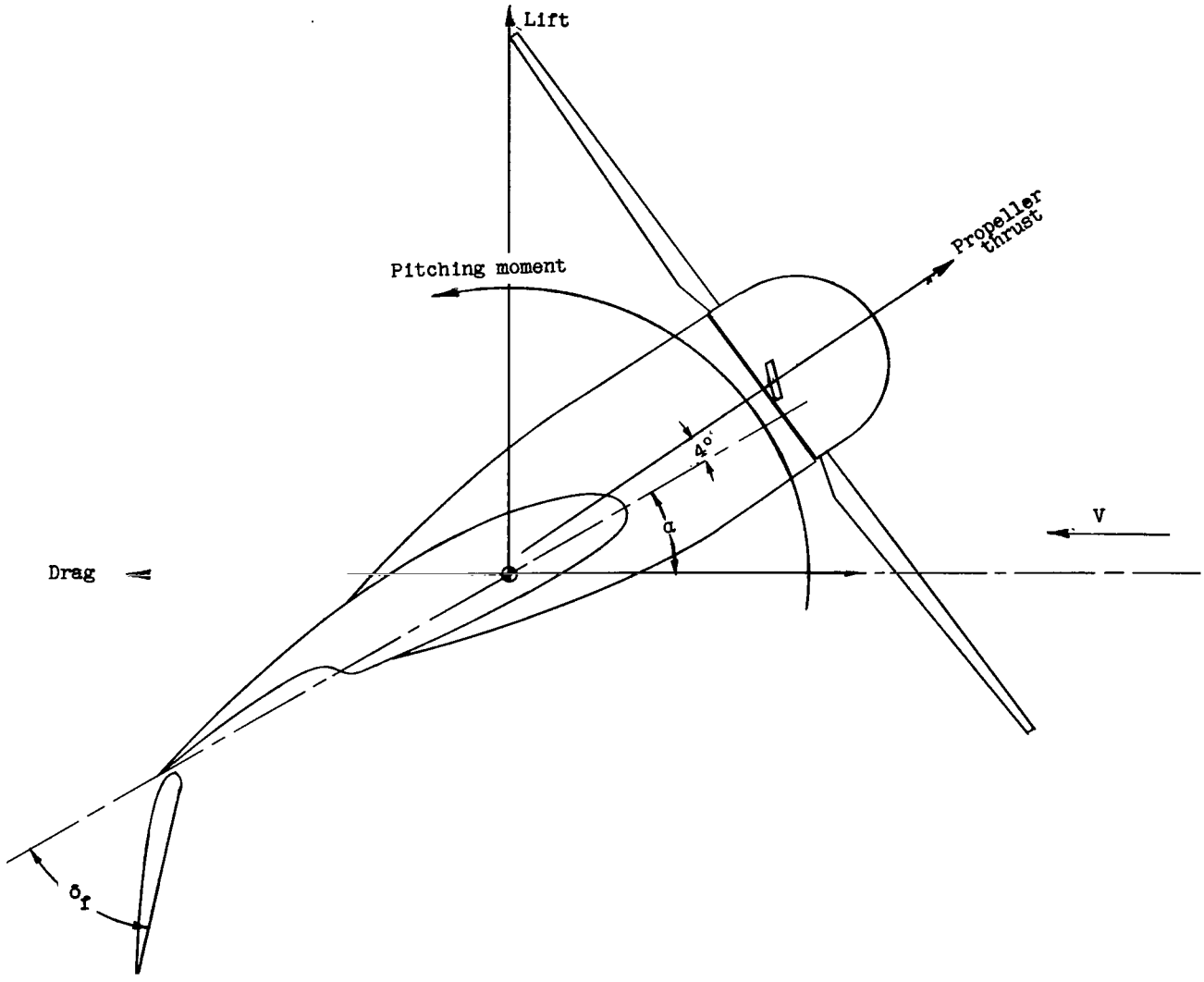
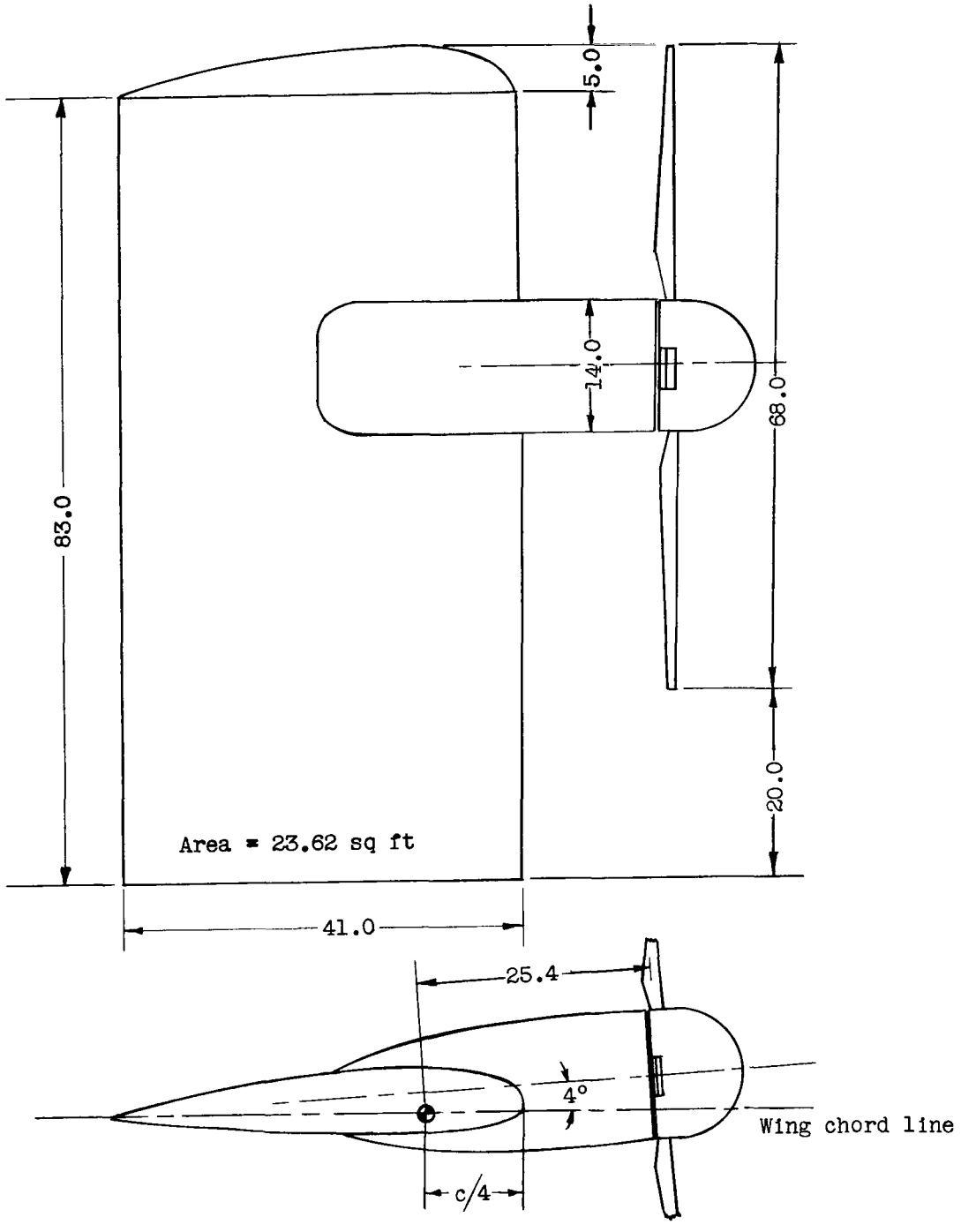
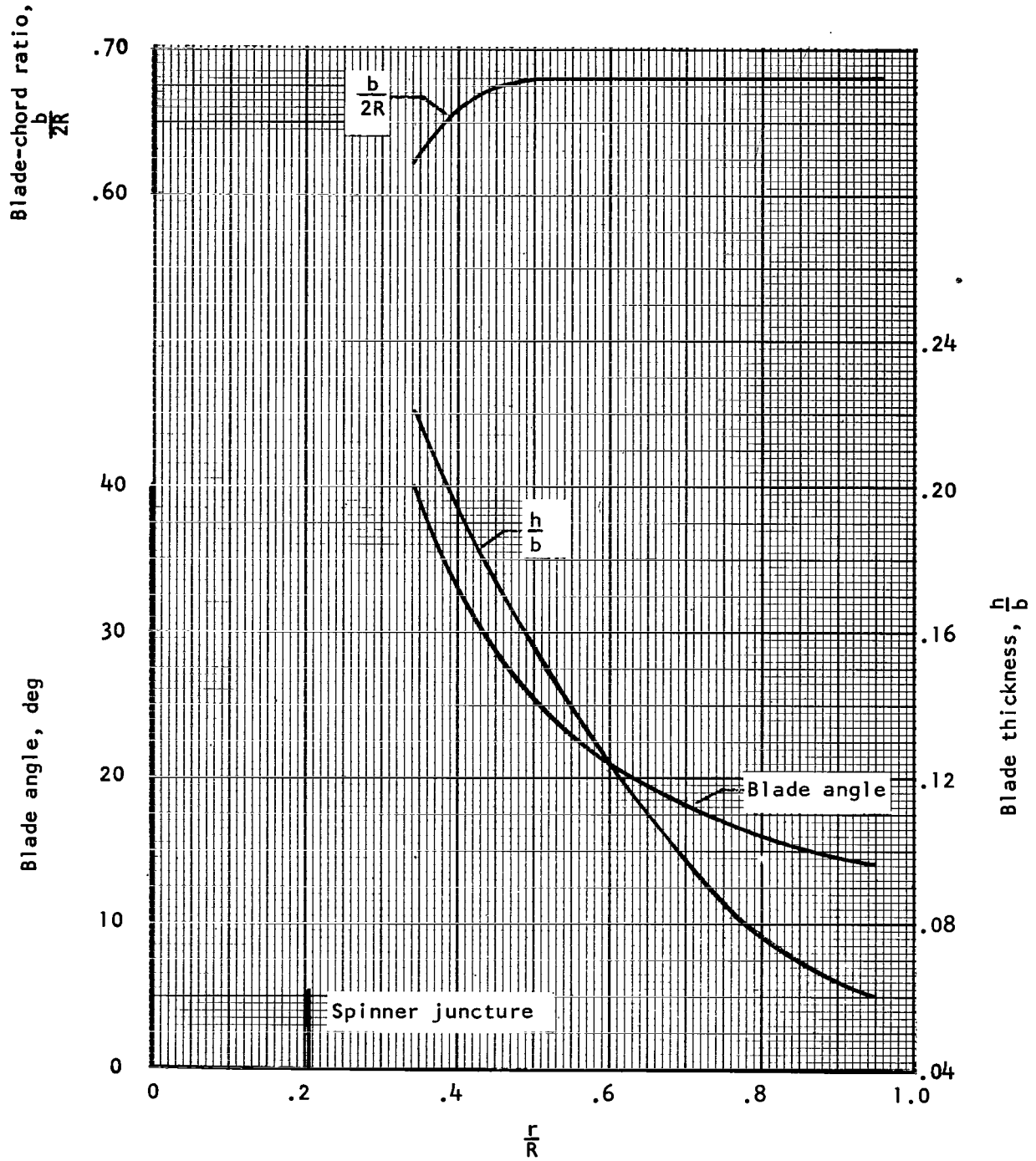


Figure 1.- The positive sense of forces, moments, and angles.



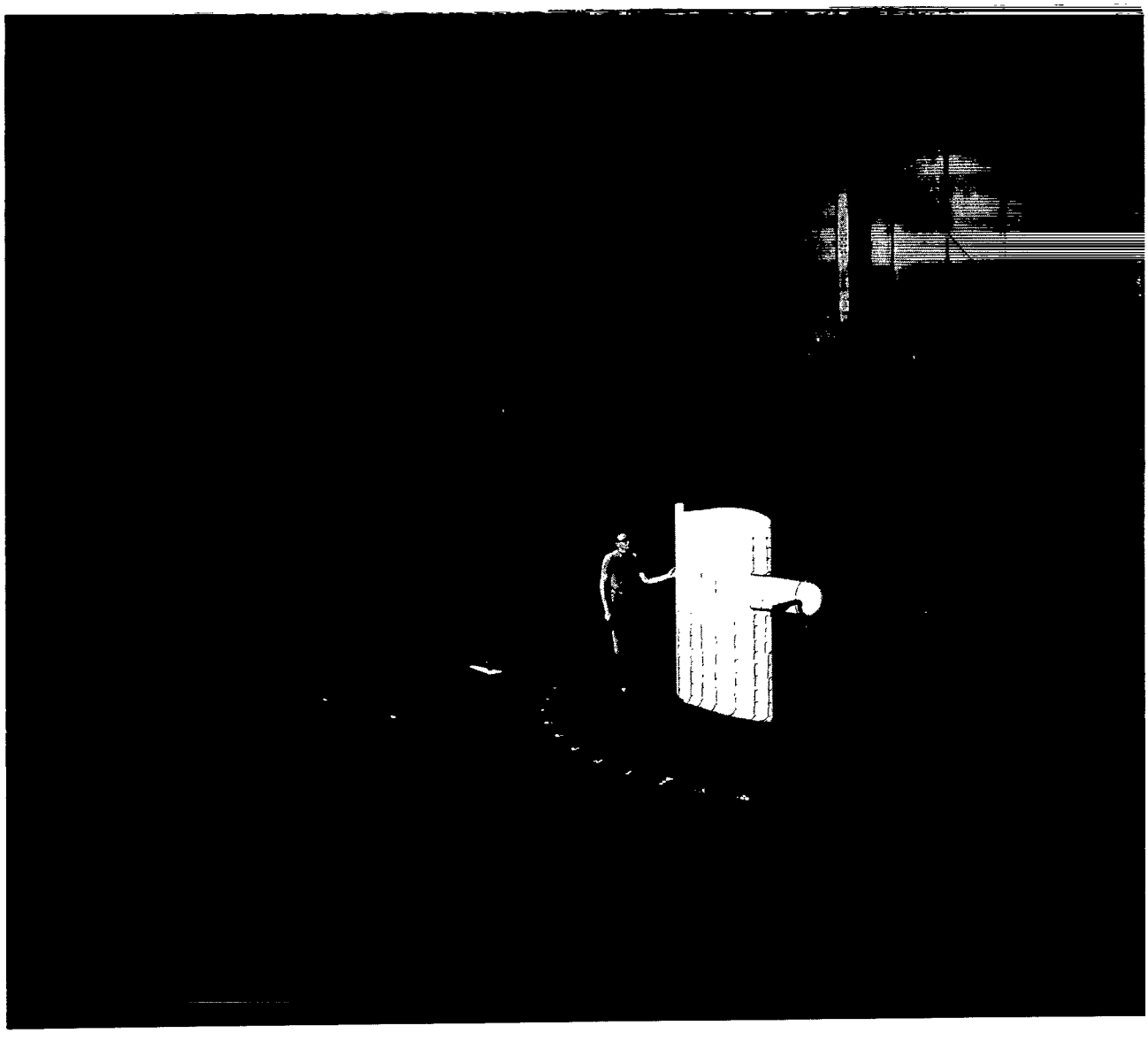
(a) Principal dimensions in inches.

Figure 2.- Principal dimensions of model, propeller blade form curves, and photograph showing model mounted in tunnel.



(b) Propeller blade form curves.

Figure 2.- Continued.



(c) Photograph of model. L-63-6467

Figure 2.- Concluded.

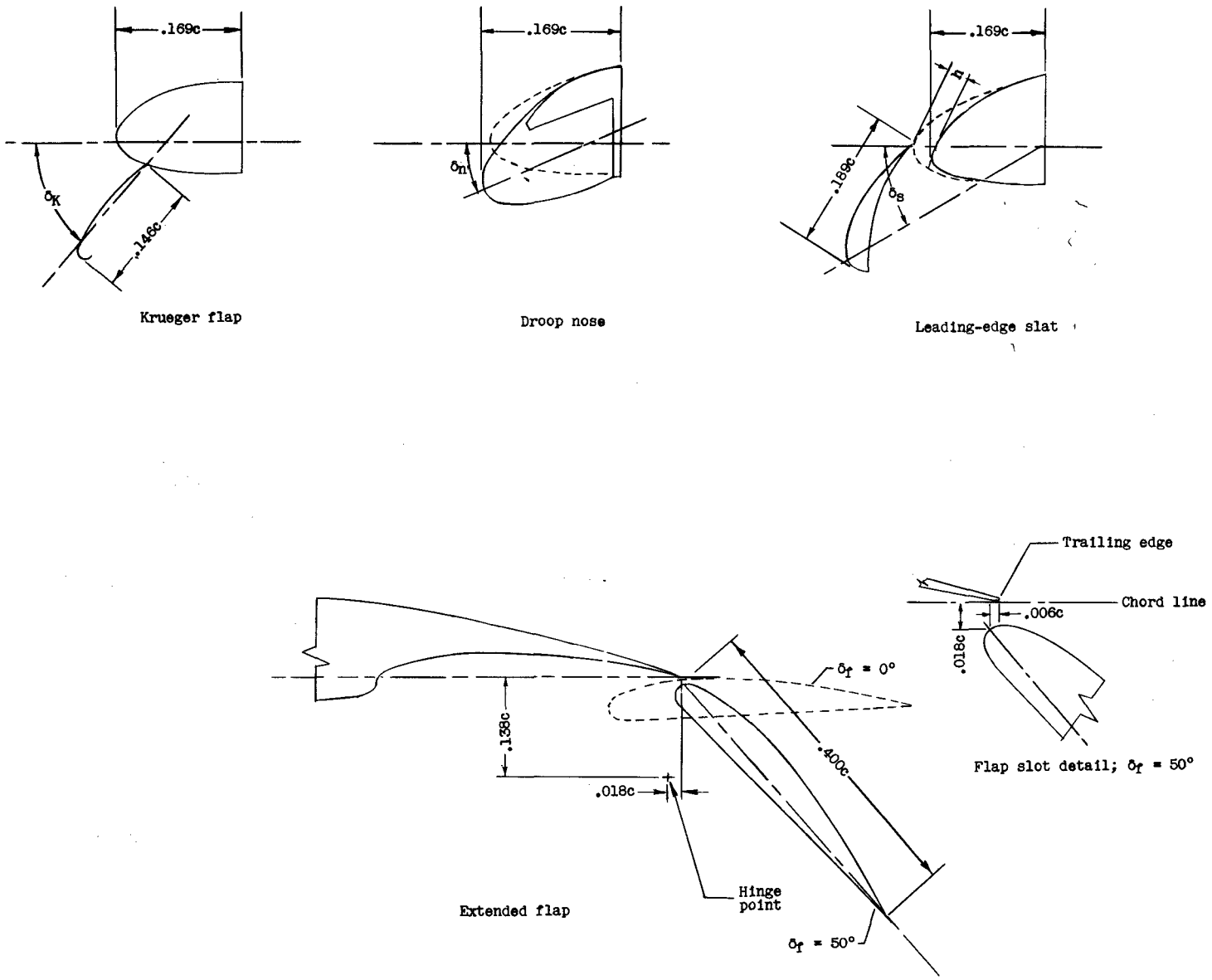
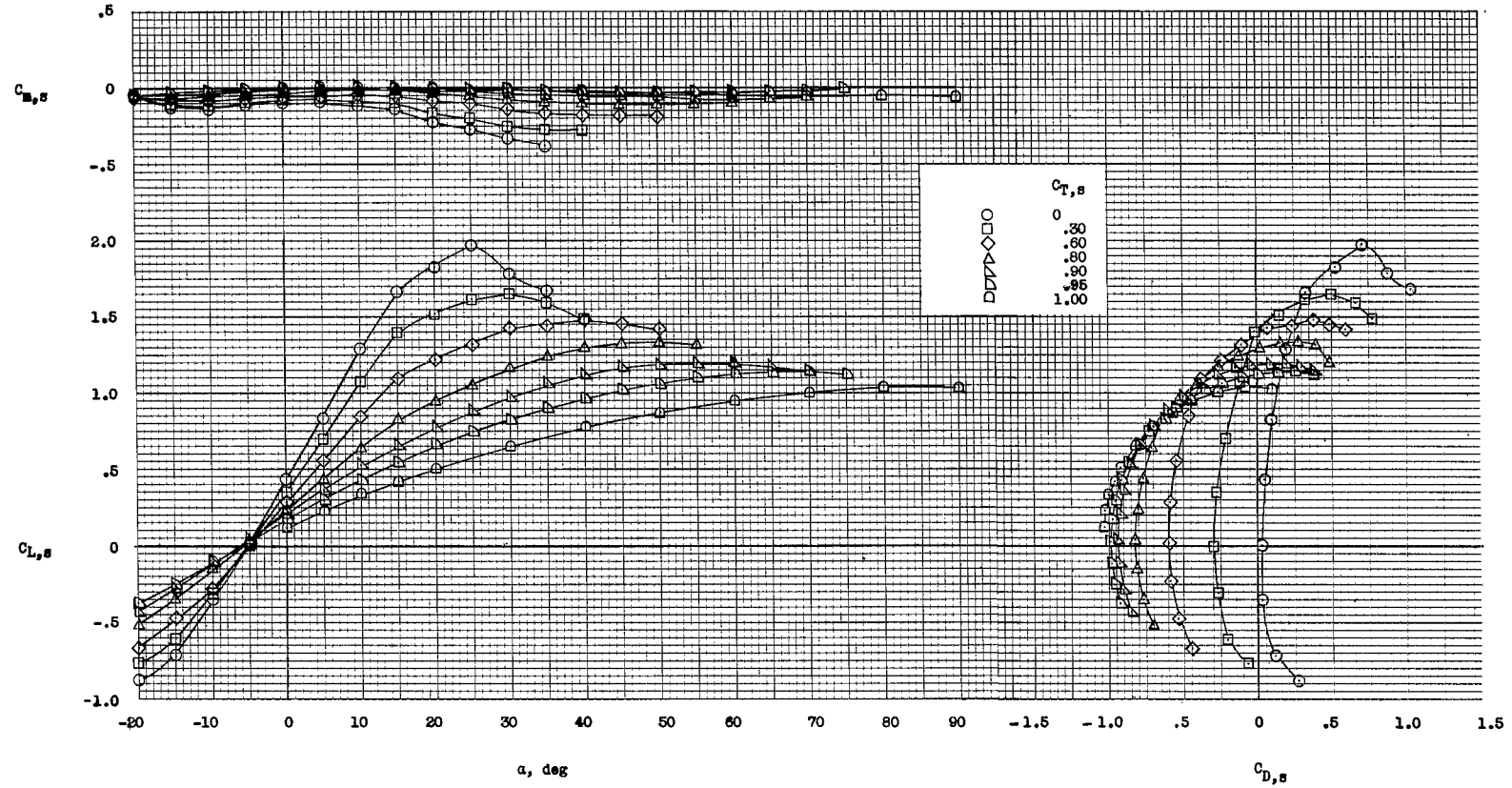
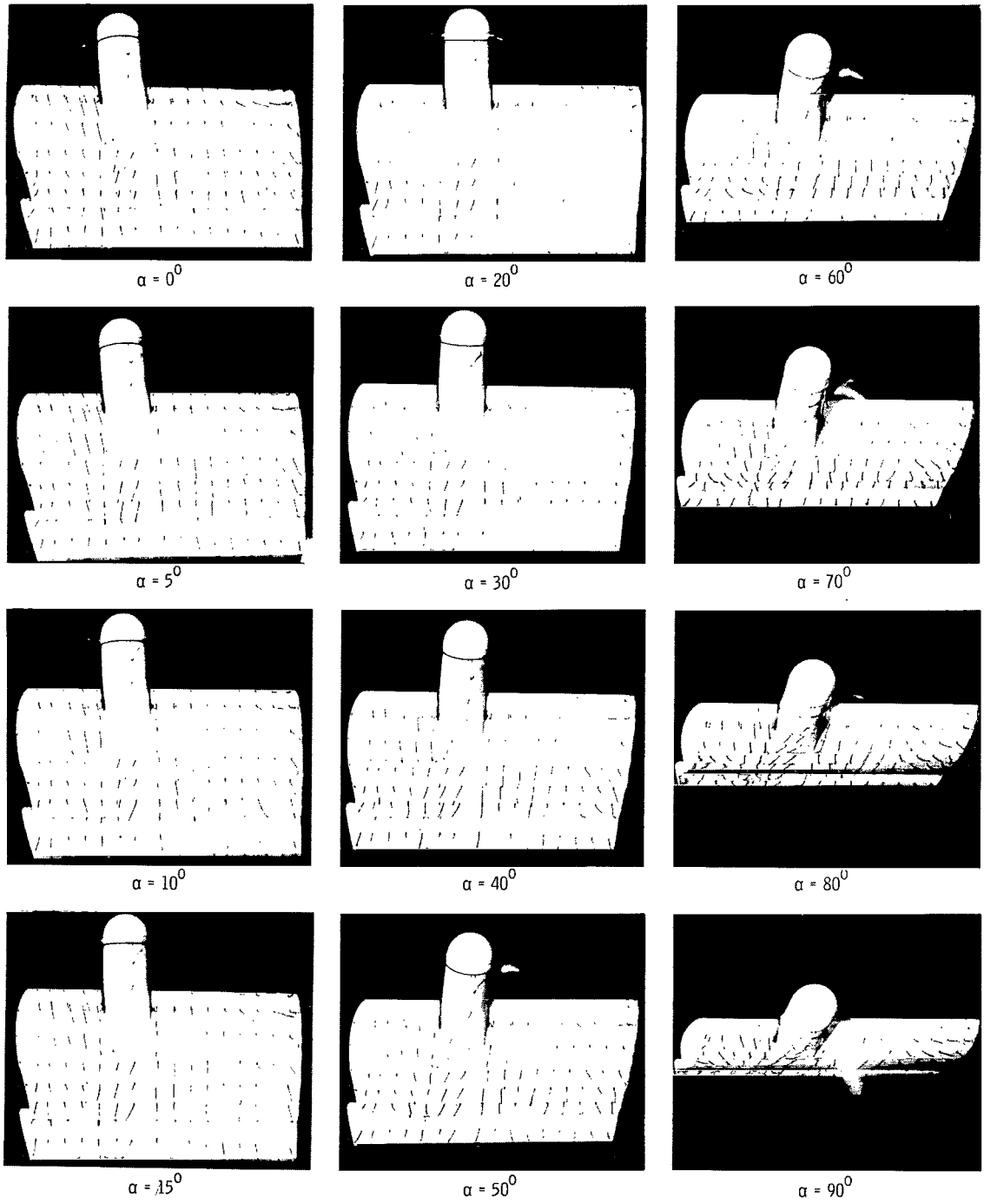


Figure 3.- Sectional views of various leading-edge devices and trailing-edge flap.



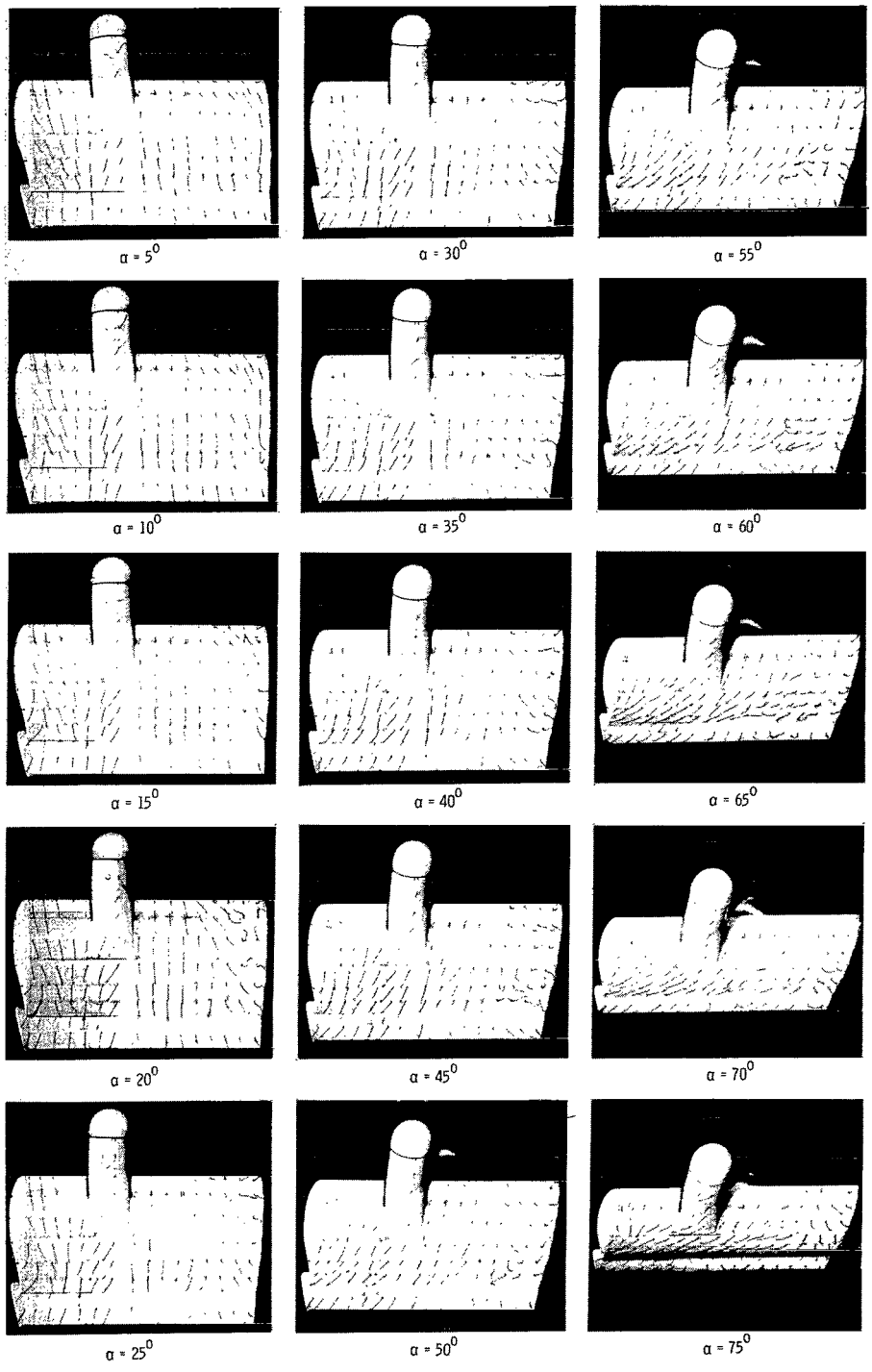
(a) Aerodynamic characteristics.

Figure 4.- Aerodynamic and flow characteristics of the model with basic leading edge and with trailing-edge flap deflected. $\delta_f = 0^\circ$. (Not retracted.)



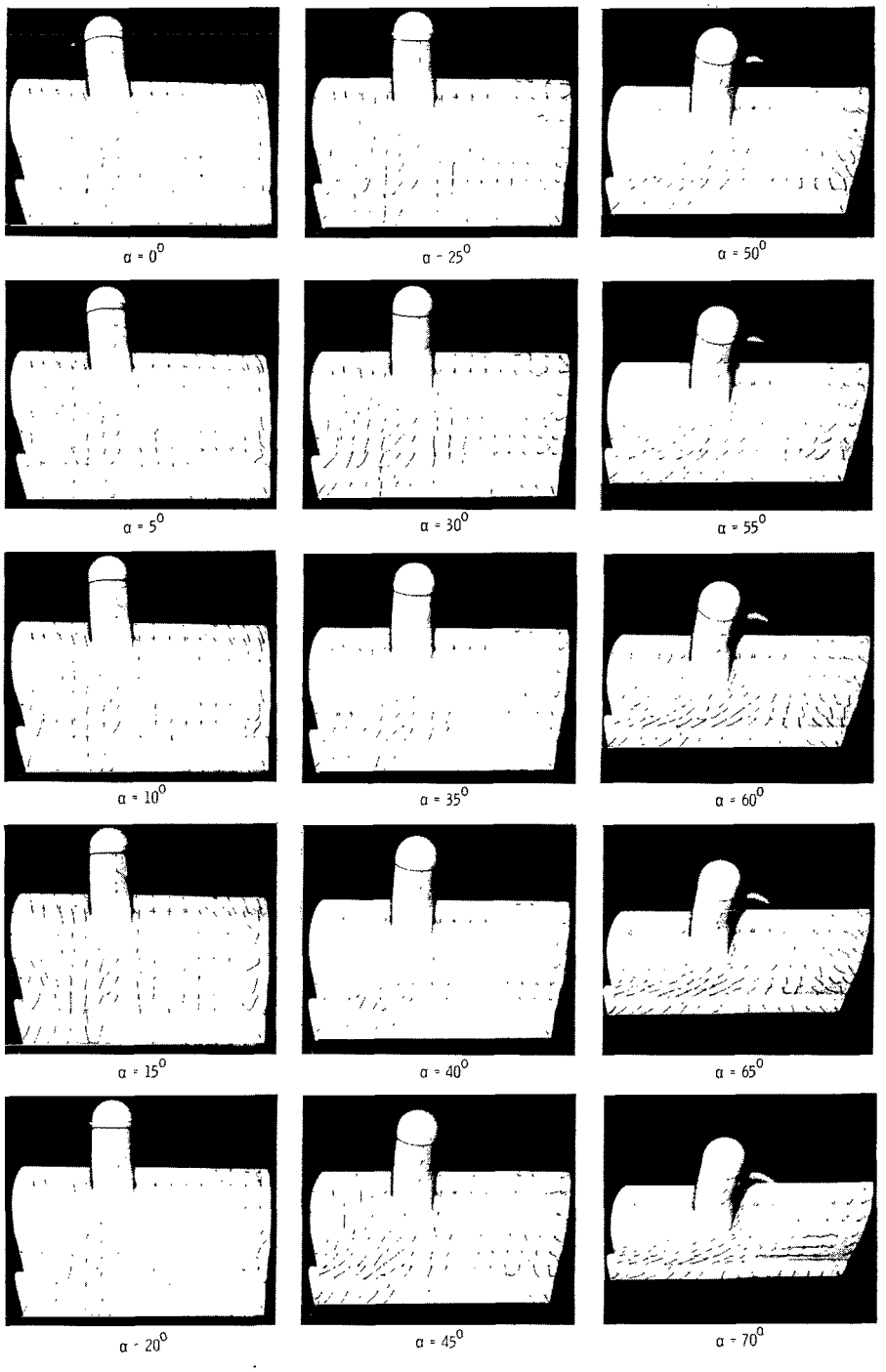
(b) Flow characteristics; $C_{T,s}$ = 1.00. L-63-7527

Figure 4.- Continued.



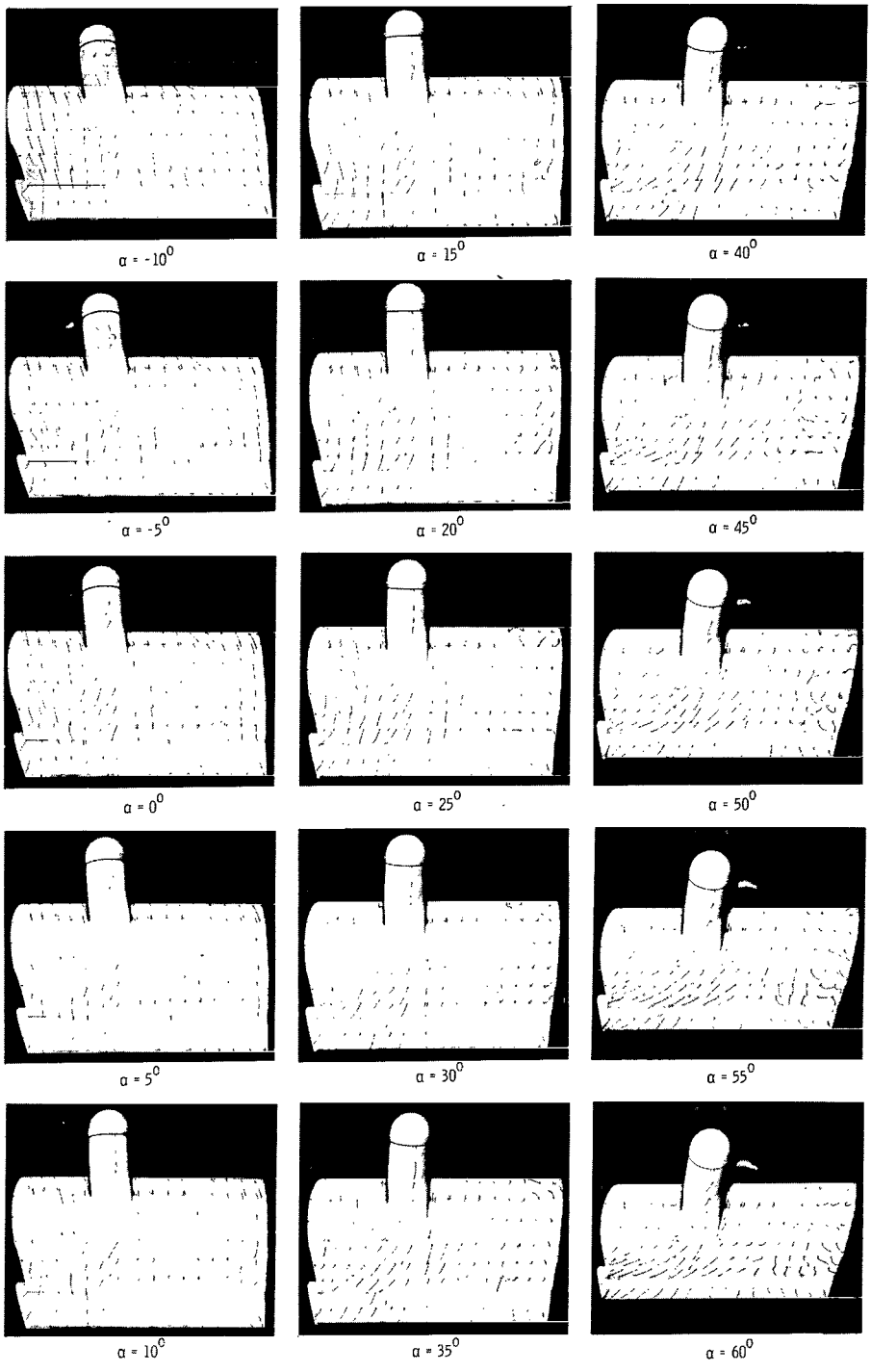
(c) Flow characteristics; $C_{T,s}$ = 0.95. L-63-7528

Figure 4.- Continued.



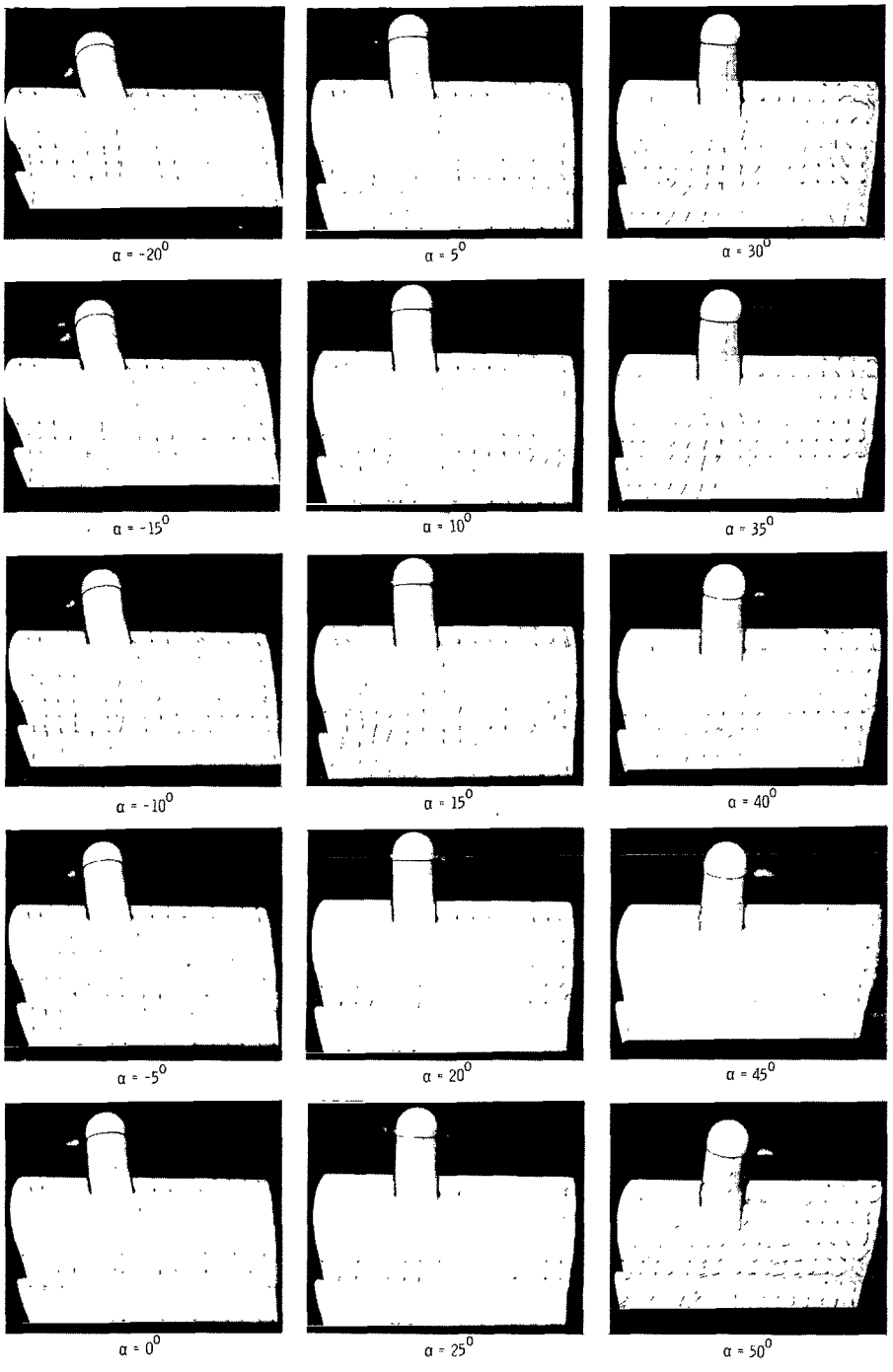
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7529

Figure 4.- Continued.



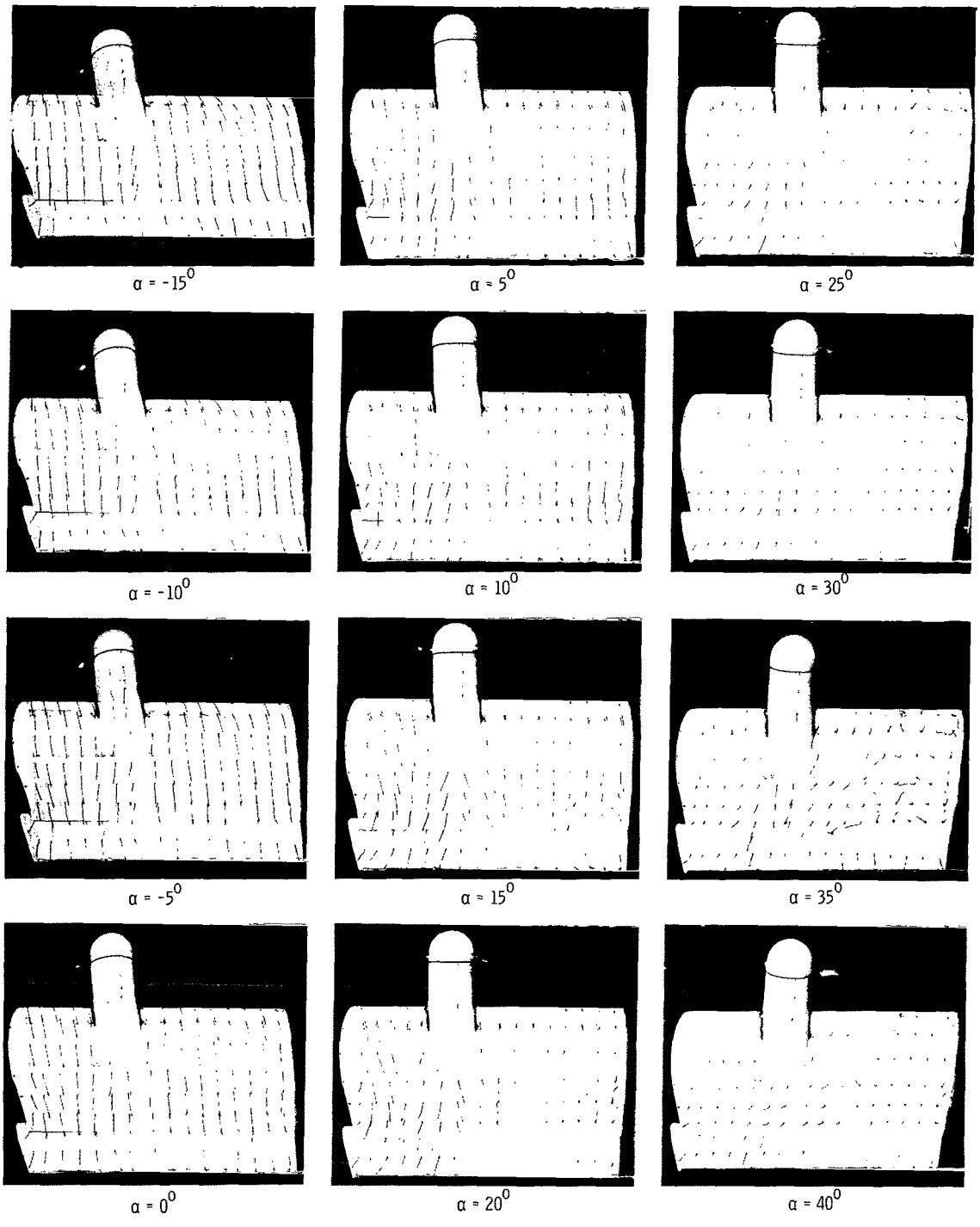
(e) Flow characteristics; $C_{T,s}$ = 0.80. L-63-7530

Figure 4.- Continued.



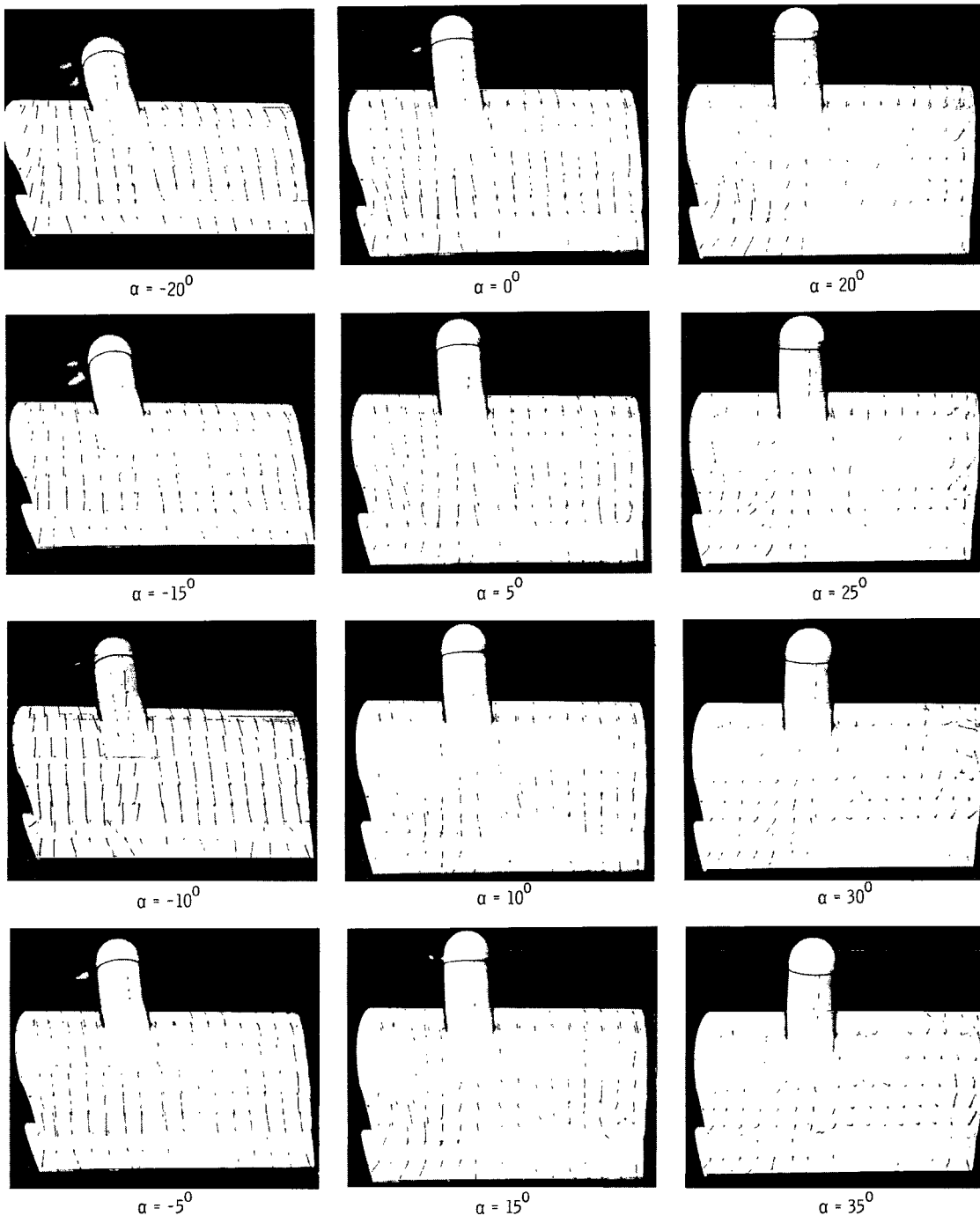
(f) Flow characteristics; $C_{T,s}$ = 0.60. L-63-7531

Figure 4.- Continued.



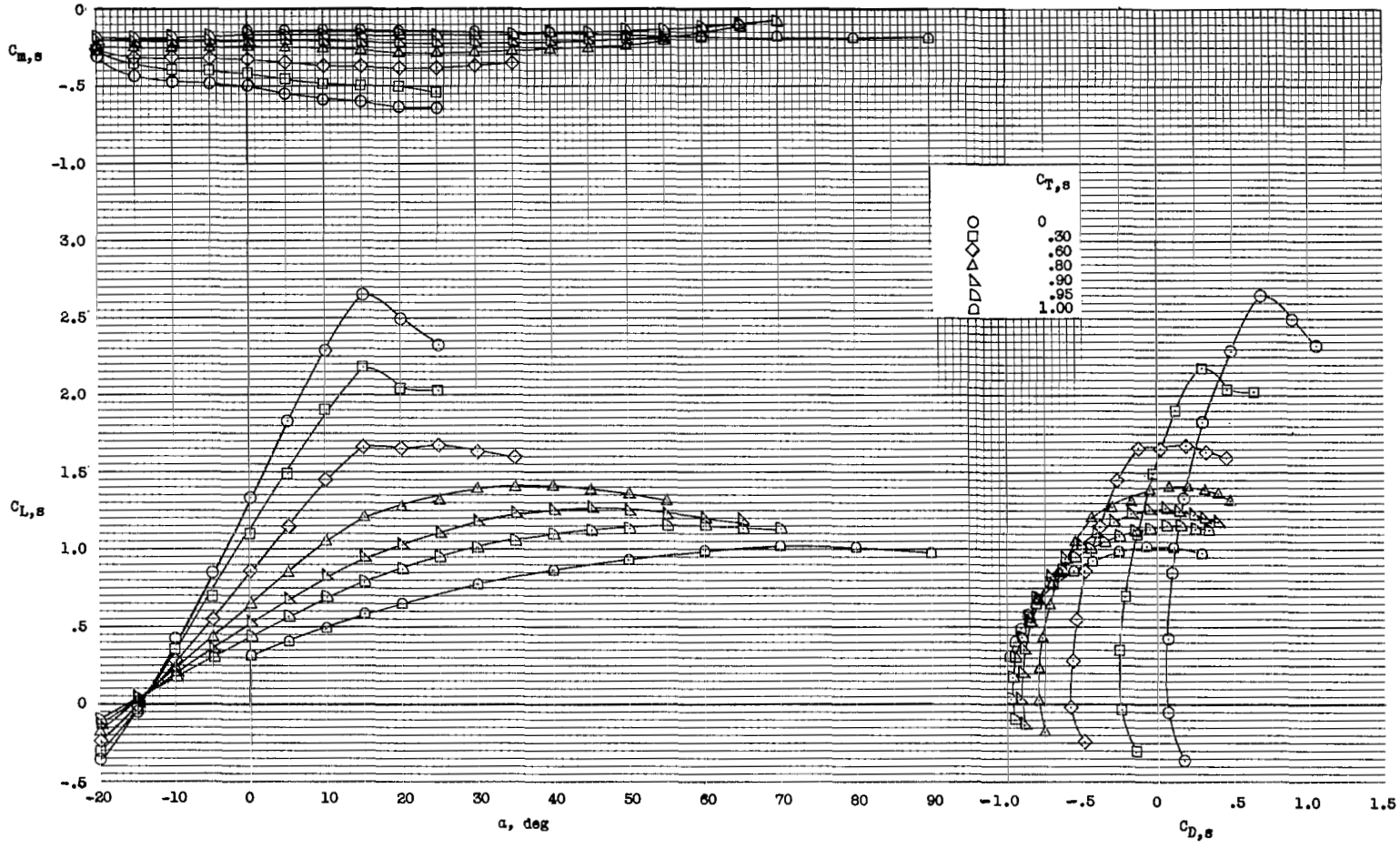
(g) Flow characteristics; $C_{T,s}$ = 0.30. L-63-7532

Figure 4.- Continued.



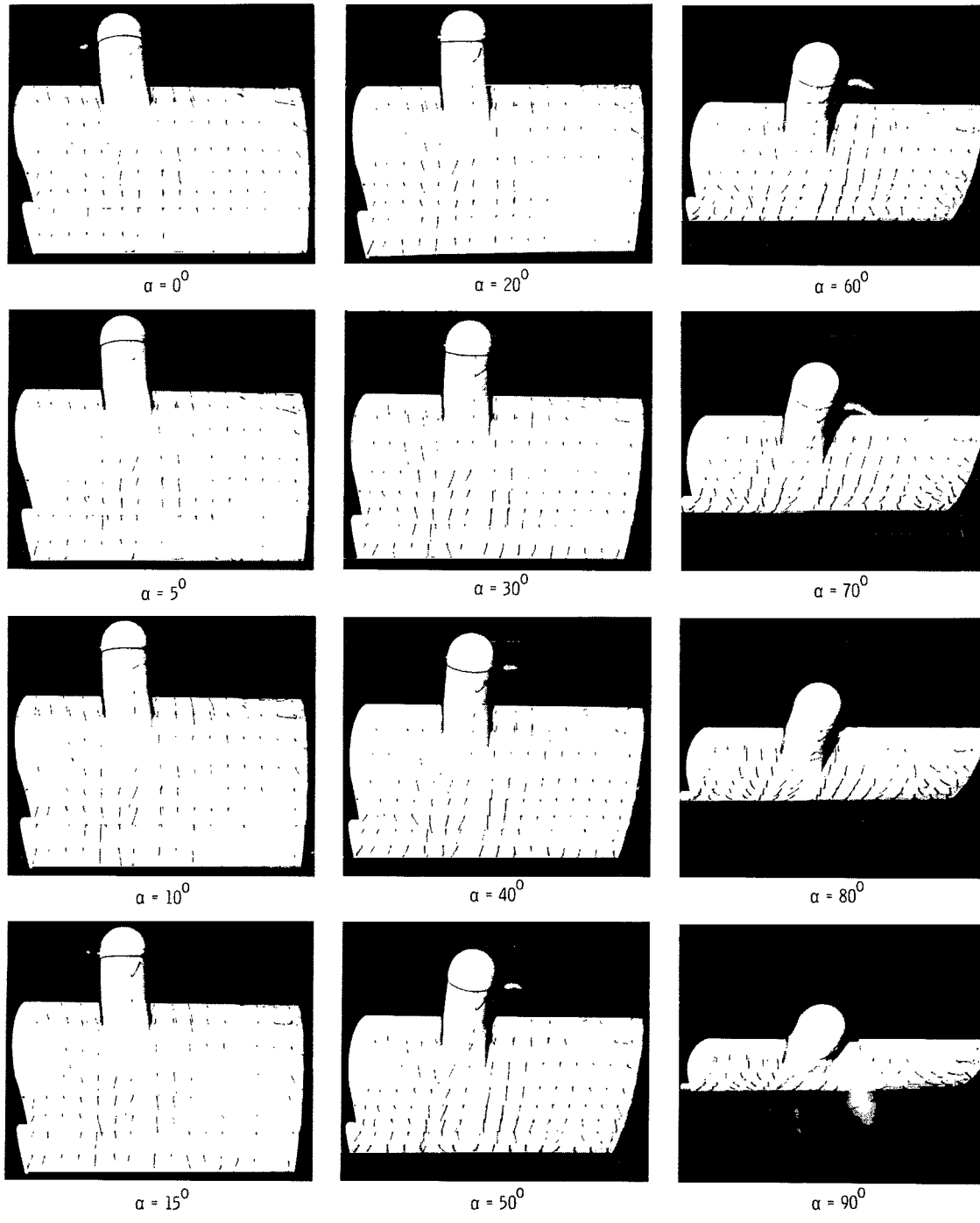
(h) Flow characteristics; $C_{T,s} = 0$. L-63-7533

Figure 4.- Concluded.



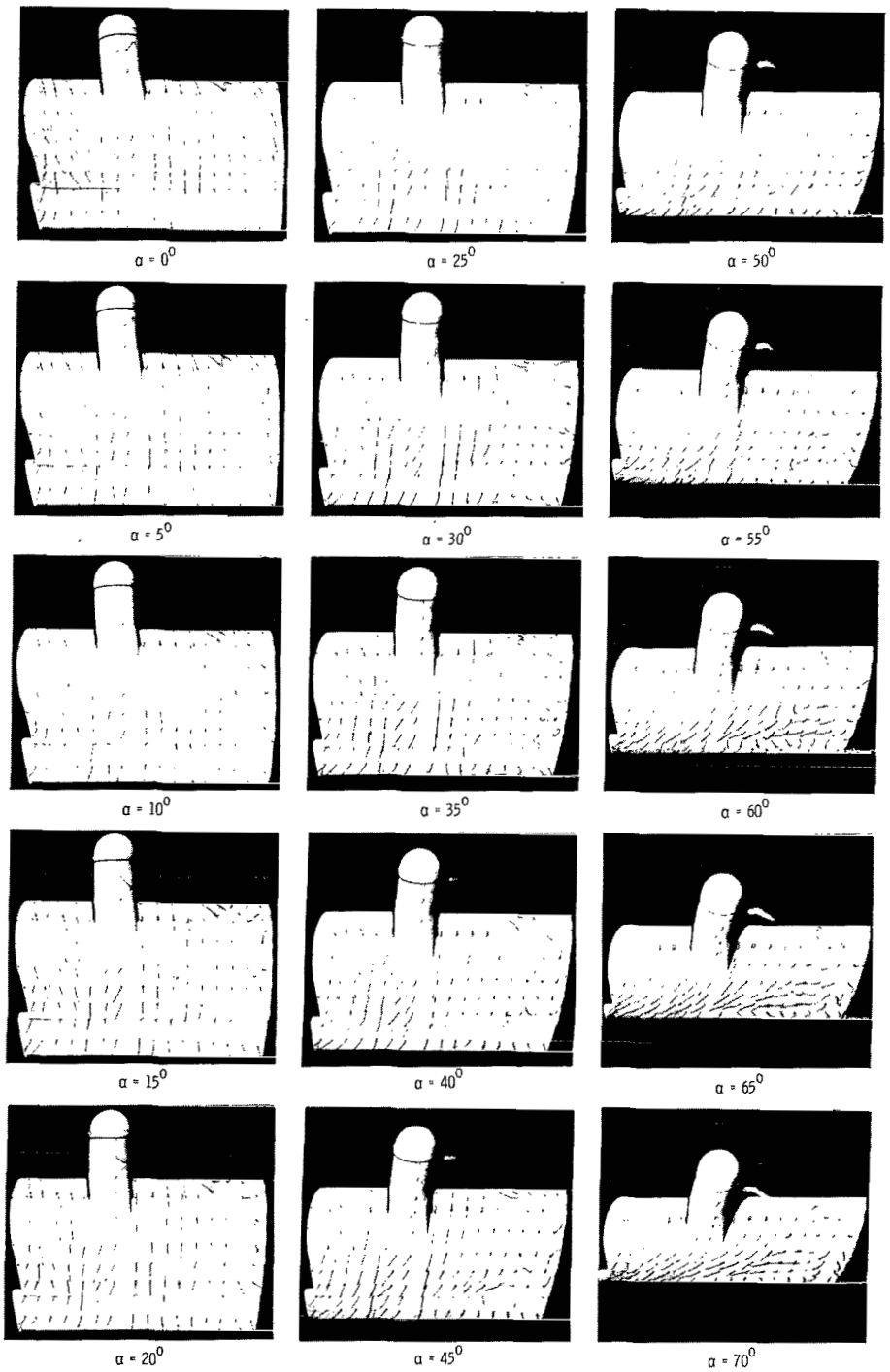
(a) Aerodynamic characteristics.

Figure 5.- Aerodynamic and flow characteristics of the model with basic leading edge and with trailing-edge flap deflected. $\delta_f = 20^\circ$.



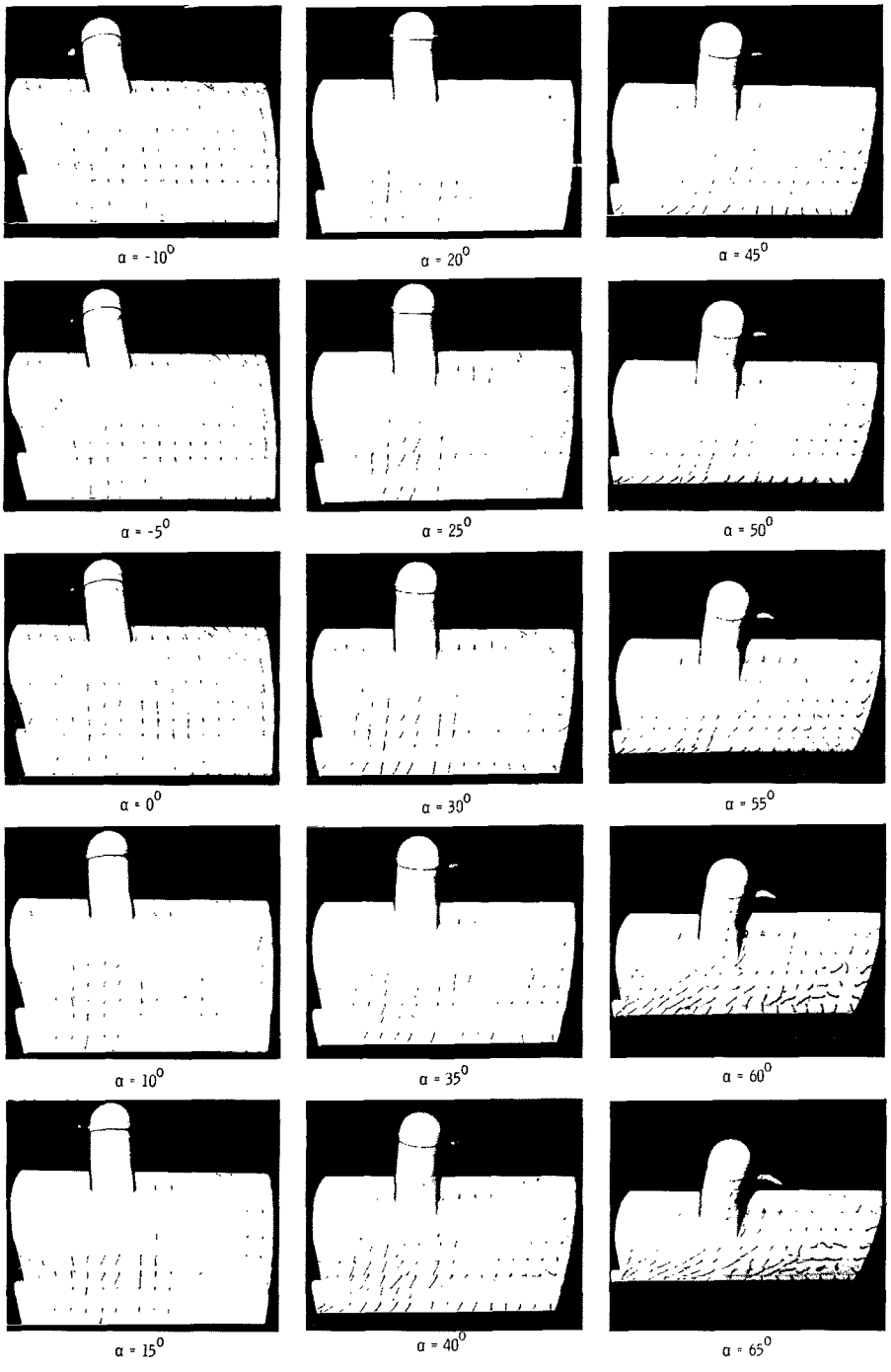
(b) Flow characteristics; $C_{T,s}$ = 1.00. L-63-7534

Figure 5.- Continued.



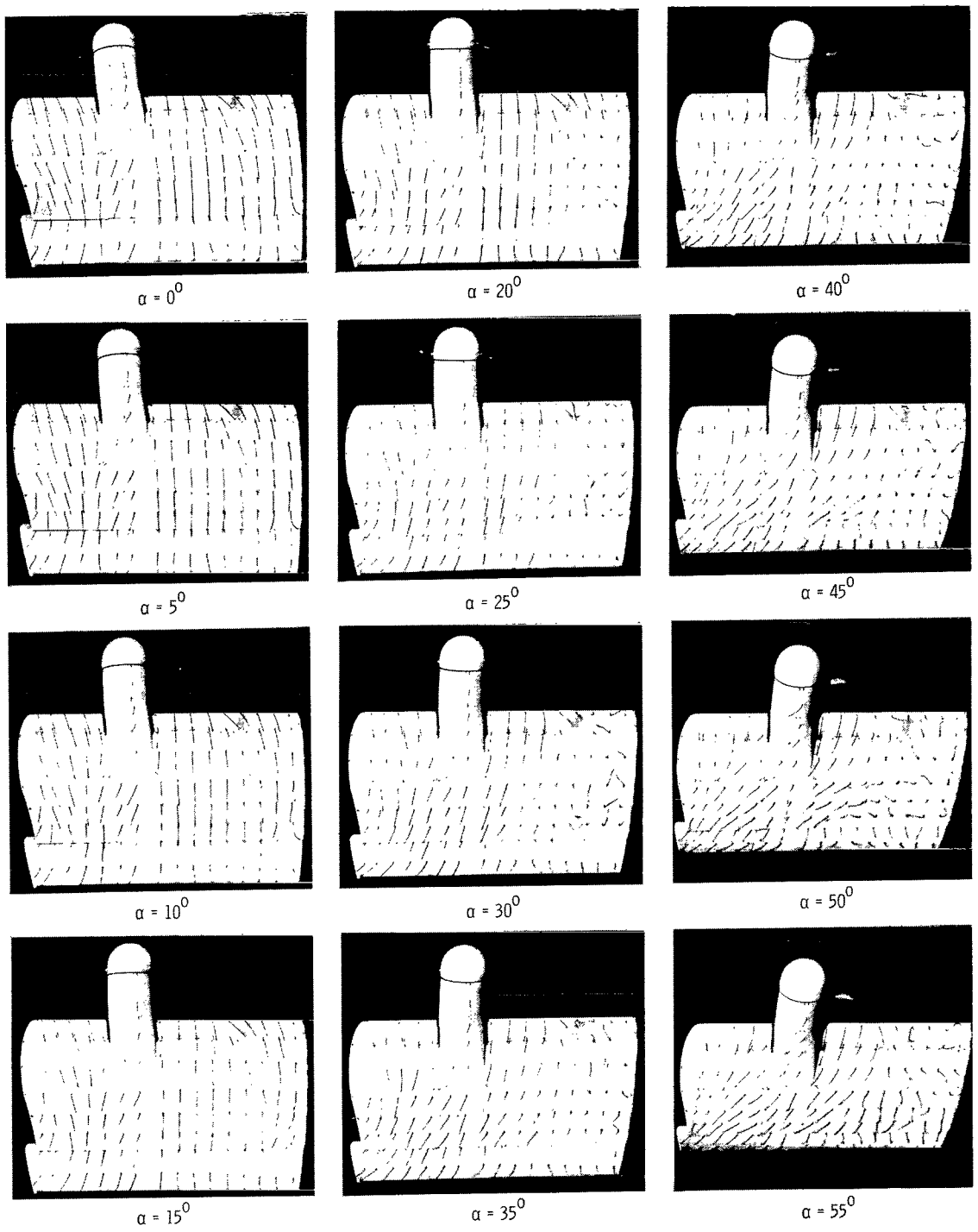
(c) Flow characteristics; $C_{T,s}$ = 0.95. L-63-7535

Figure 5.- Continued.



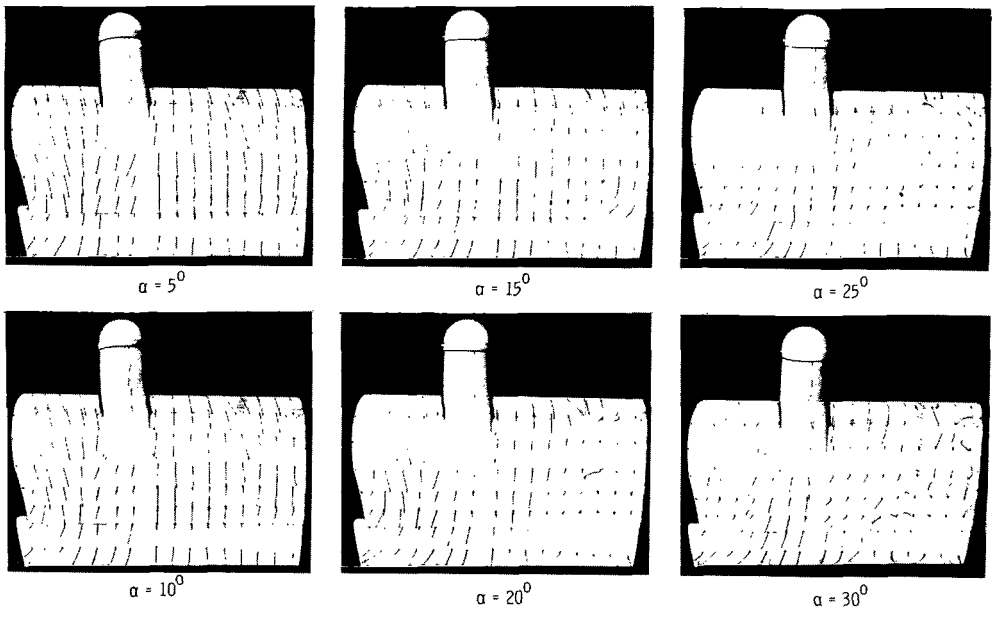
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7536

Figure 5.- Continued.

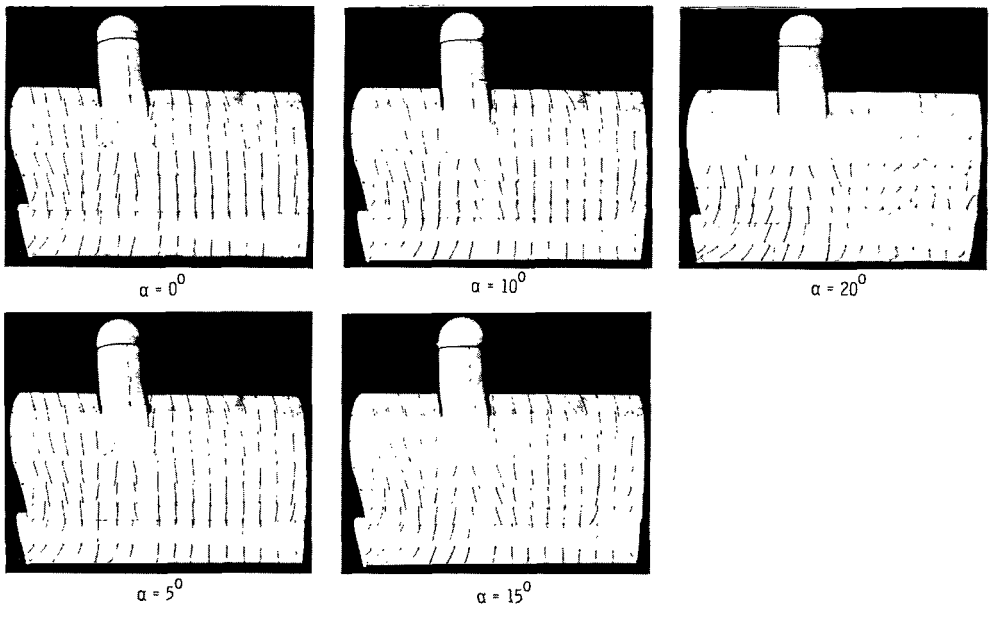


(e) Flow characteristics; $C_{T,s} = 0.80$. L-63-7537

Figure 5.- Continued.

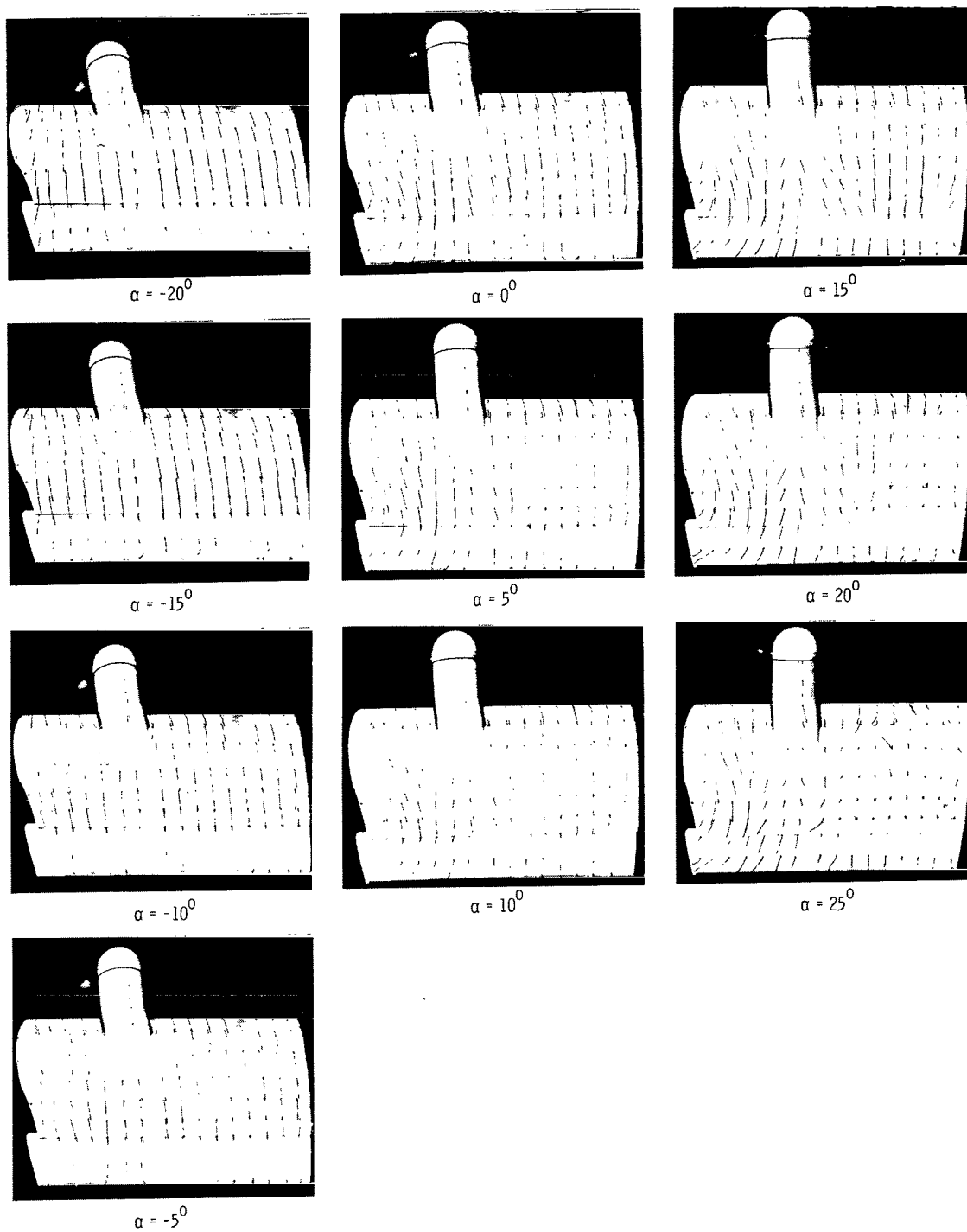


(f) Flow characteristics; $C_{T,s}$ = 0.60. L-63-7538



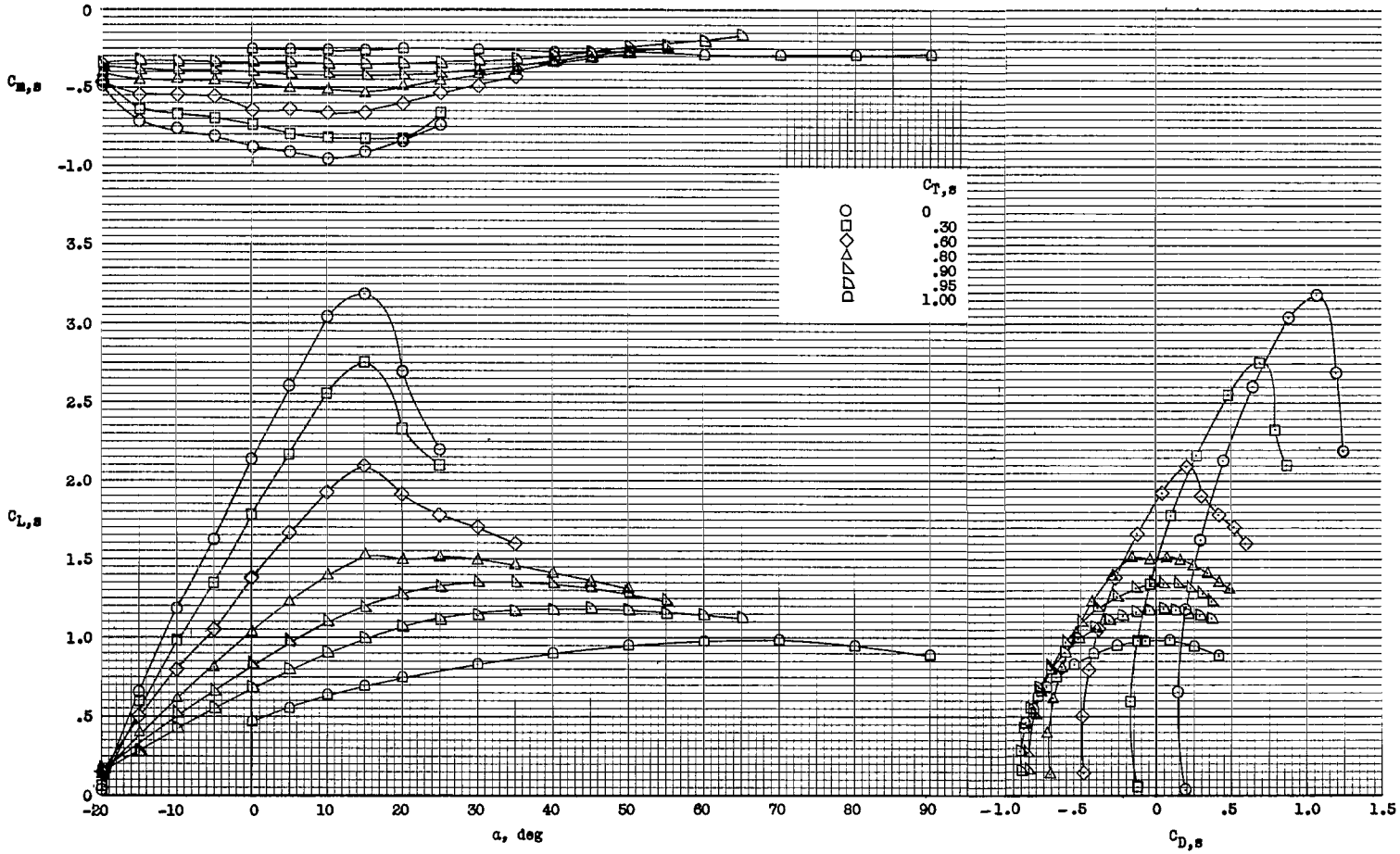
(g) Flow characteristics; $C_{T,s}$ = 0.30. L-63-7539

Figure 5.- Continued.



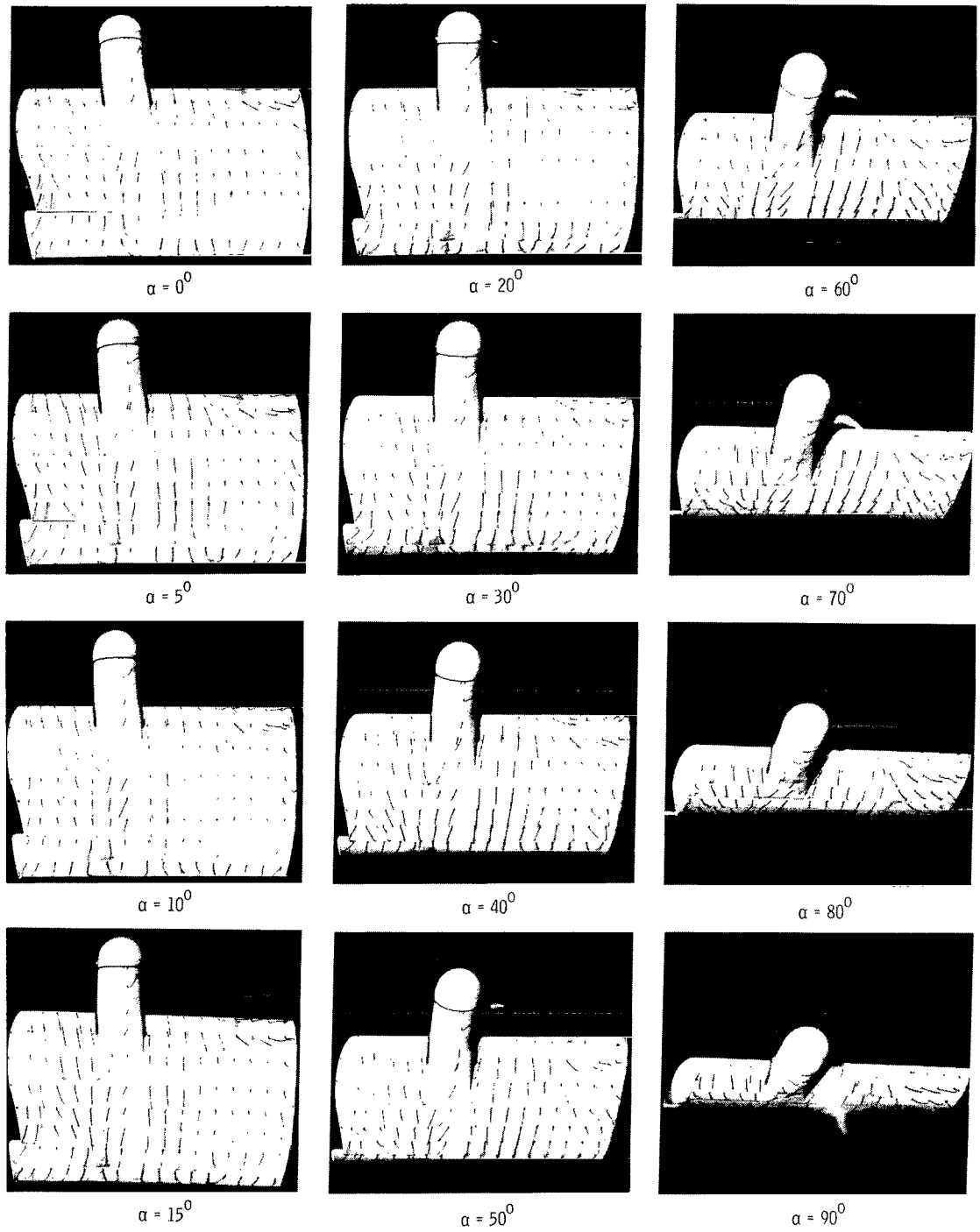
(h) Flow characteristics; $C_{T,s} = 0$. L-63-7540

Figure 5.- Concluded.



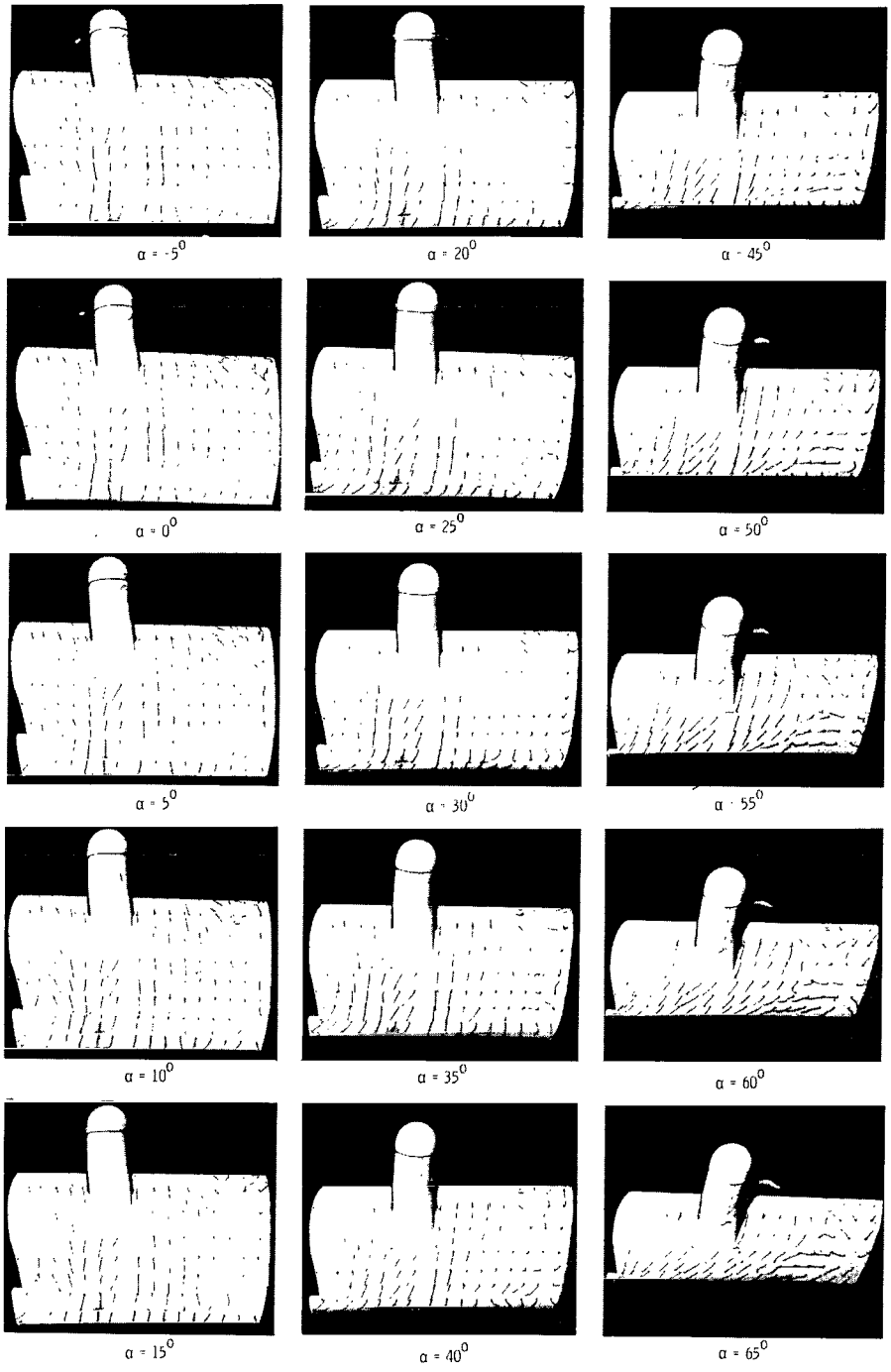
(a) Aerodynamic characteristics.

Figure 6.- Aerodynamic and flow characteristics of the model with basic leading edge and with trailing-edge flap deflected. $\delta_f = 40^\circ$.



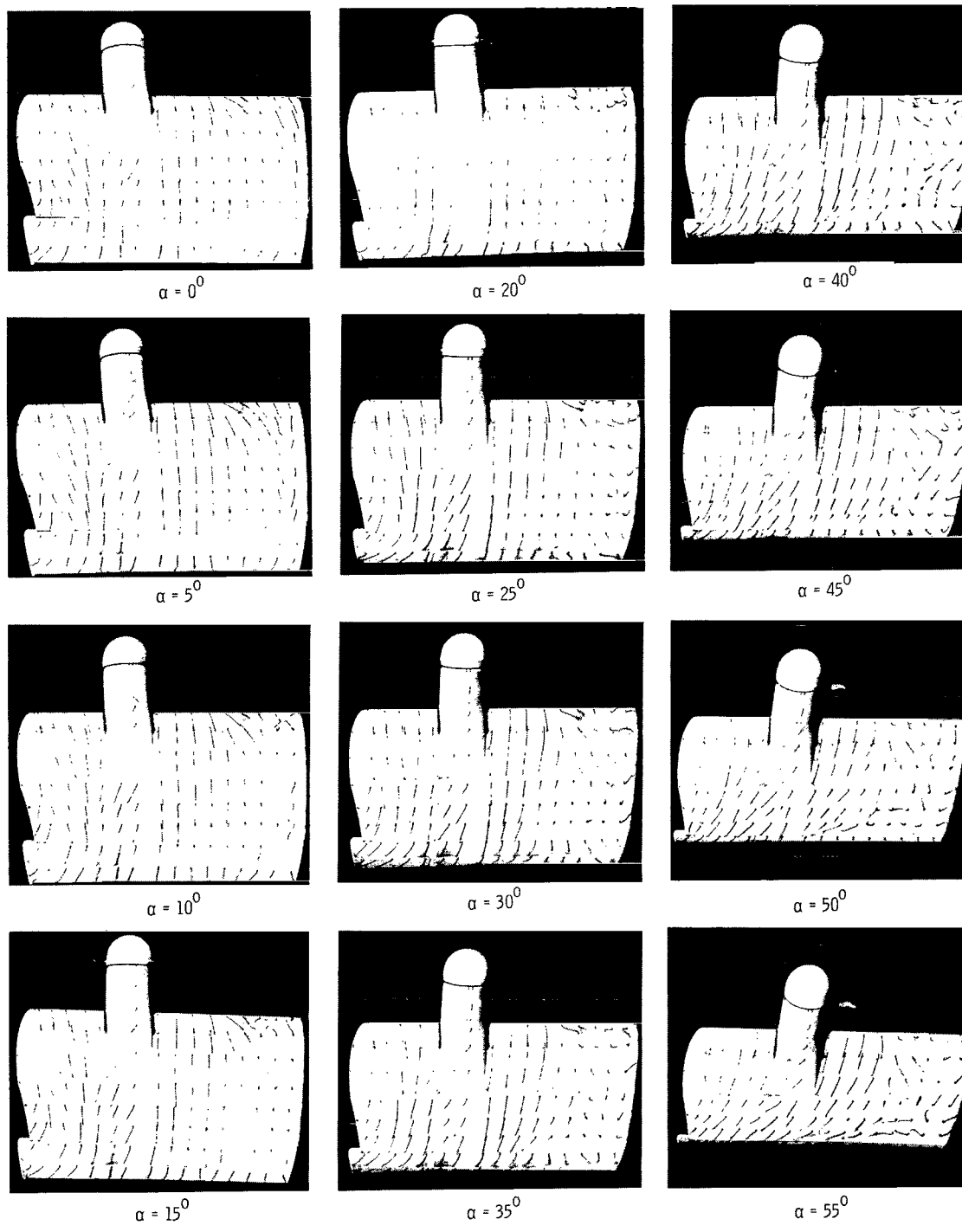
(b) Flow characteristics; $C_{T,s}$ = 1.00. L-63-7541

Figure 6.- Continued.



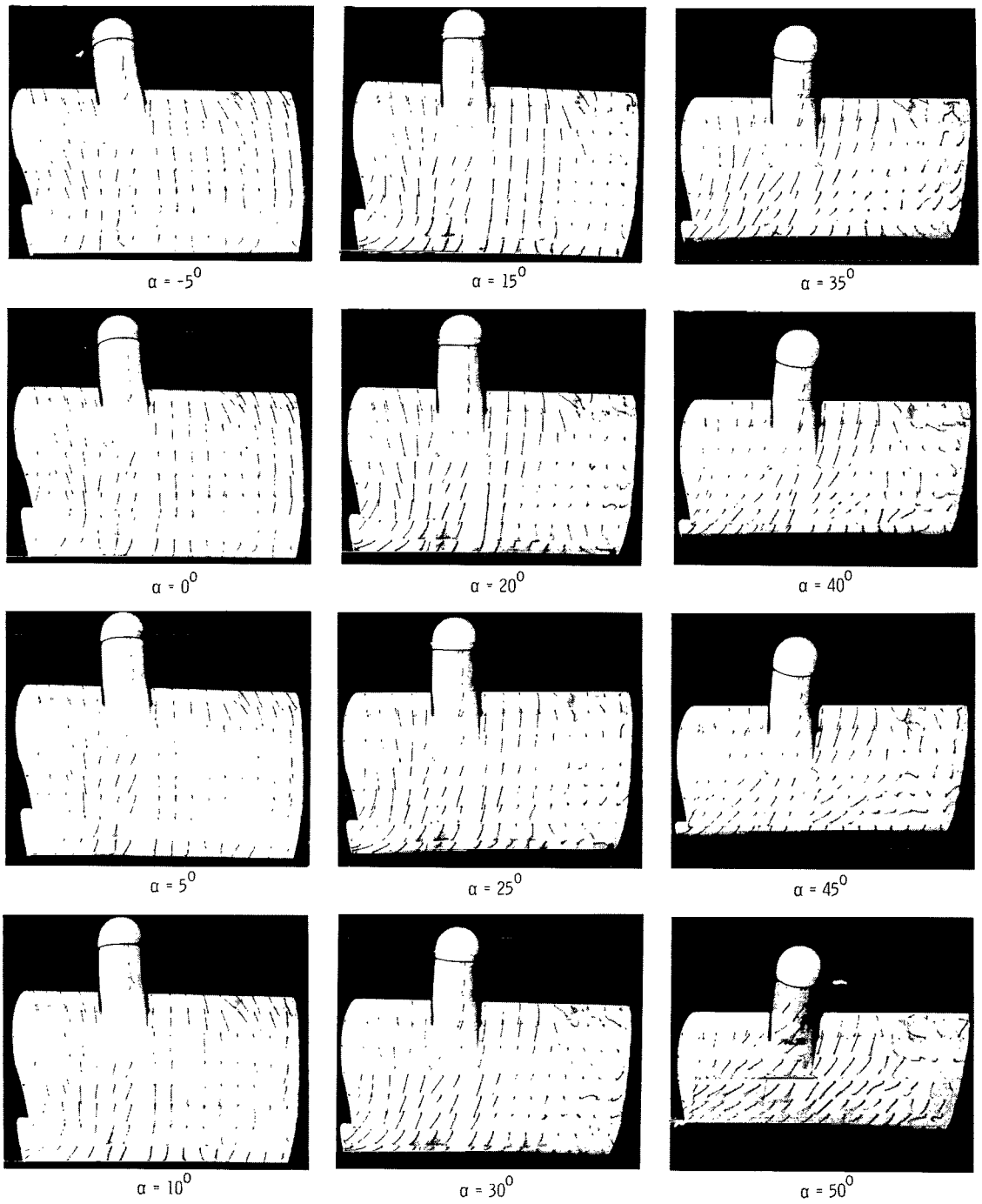
(c) Flow characteristics; $C_{T,s}$ = 0.95. L-63-7542

Figure 6.- Continued.



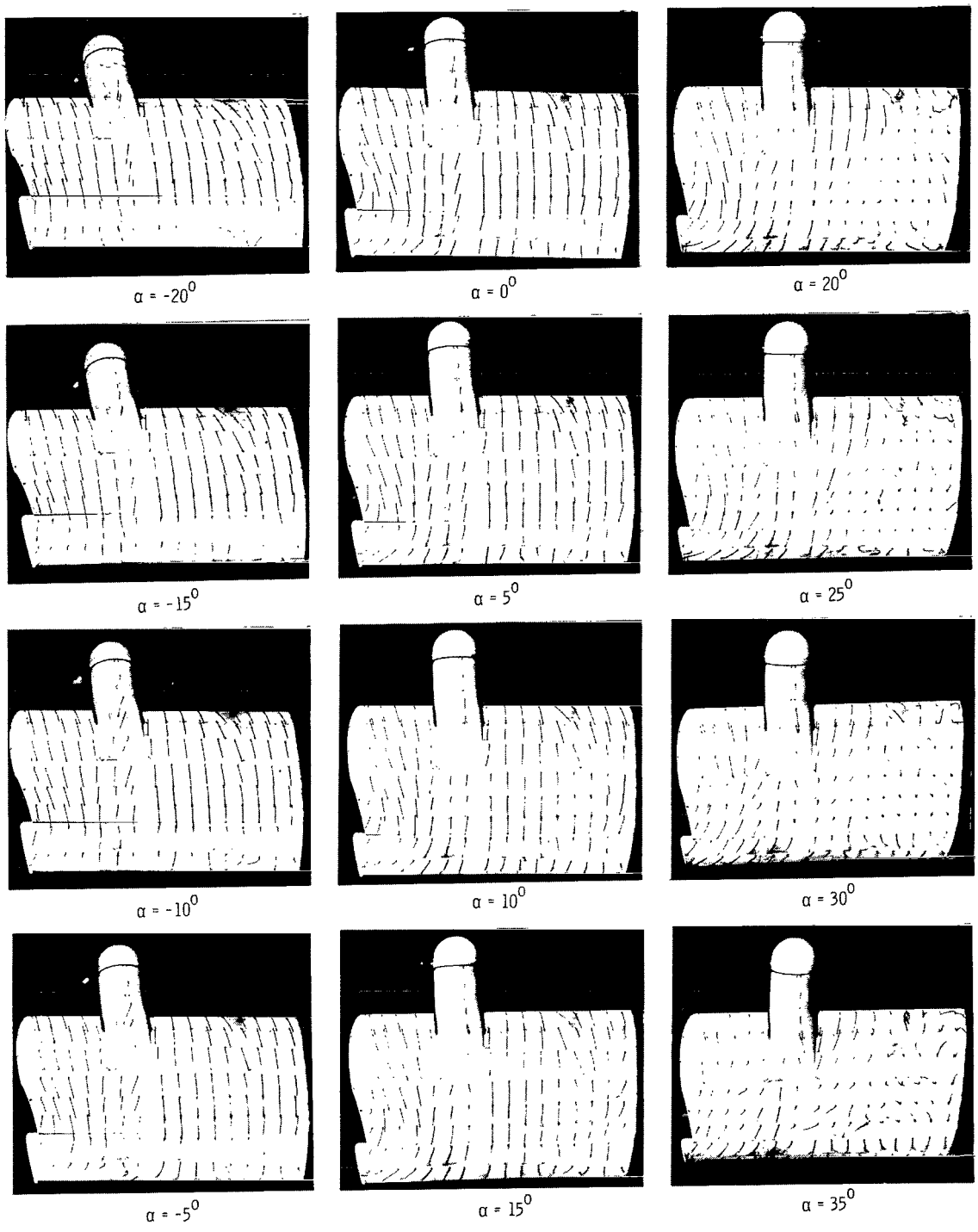
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7543

Figure 6.- Continued.



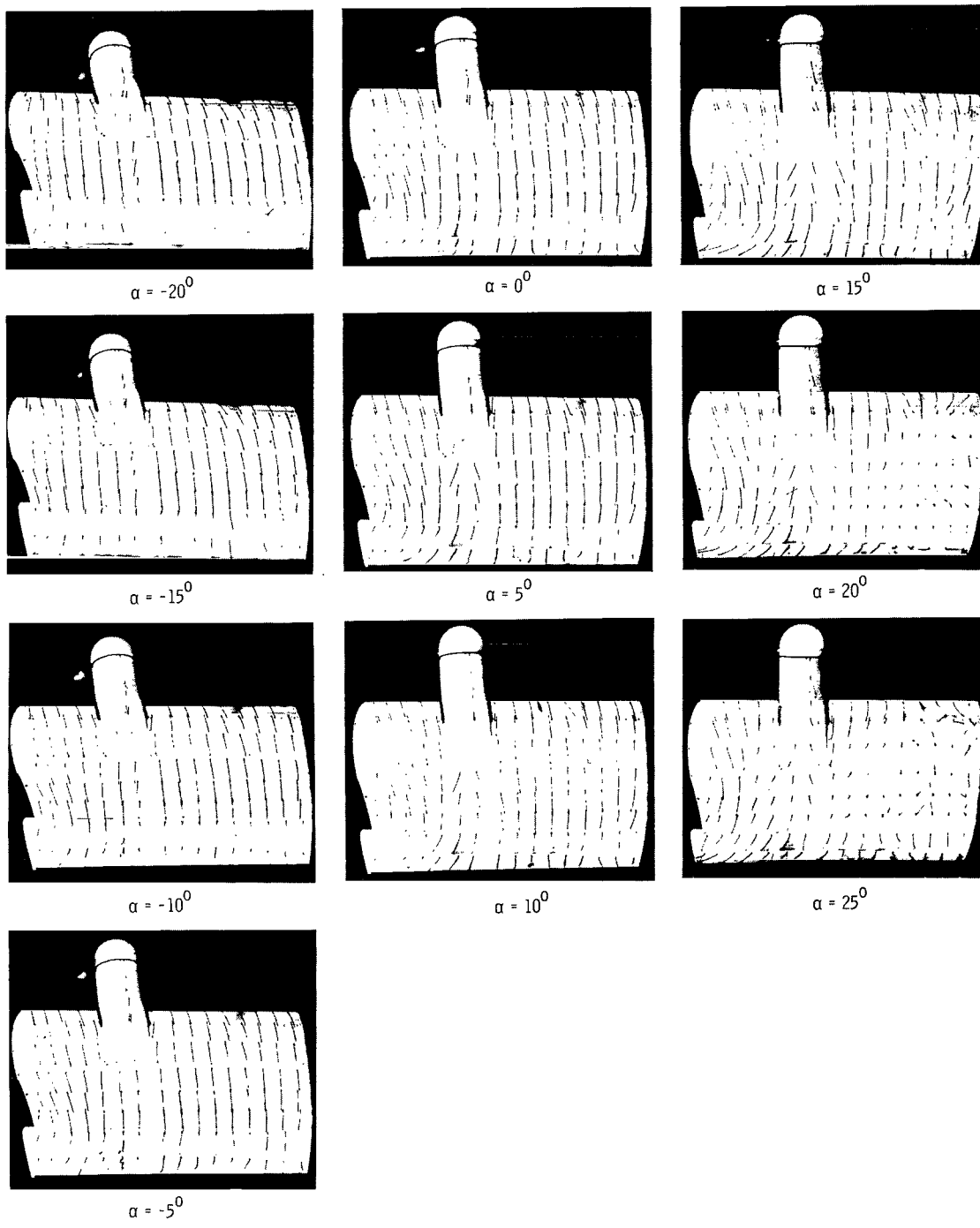
(e) Flow characteristics; $C_{T,s}$ = 0.80. L-63-7544

Figure 6.- Continued.



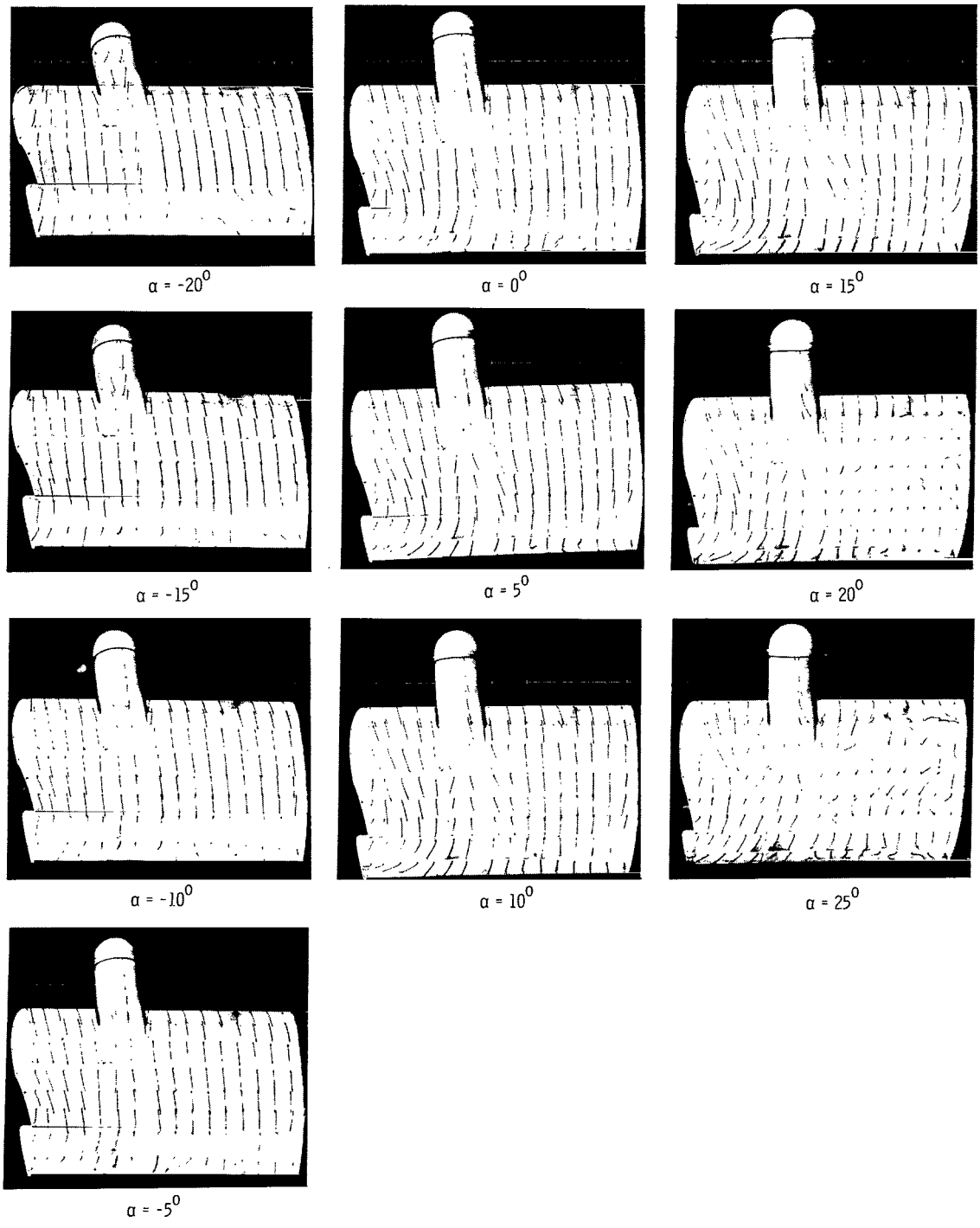
(f) Flow characteristics; $C_{T,s}$ = 0.60. L-63-7545

Figure 6.- Continued.



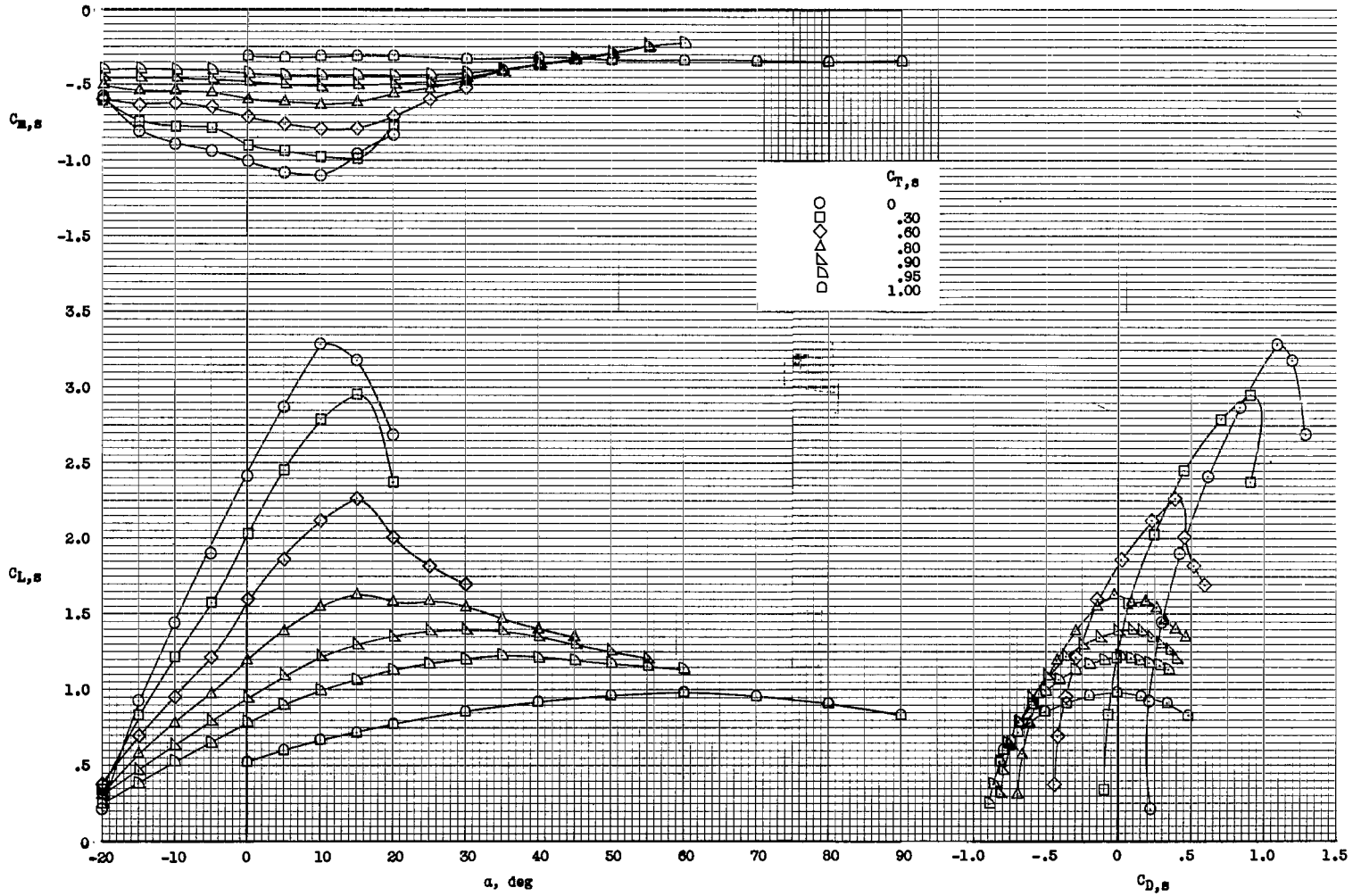
(g) Flow characteristics; $C_{T,s} = 0.30$. L-63-7546

Figure 6.- Continued.



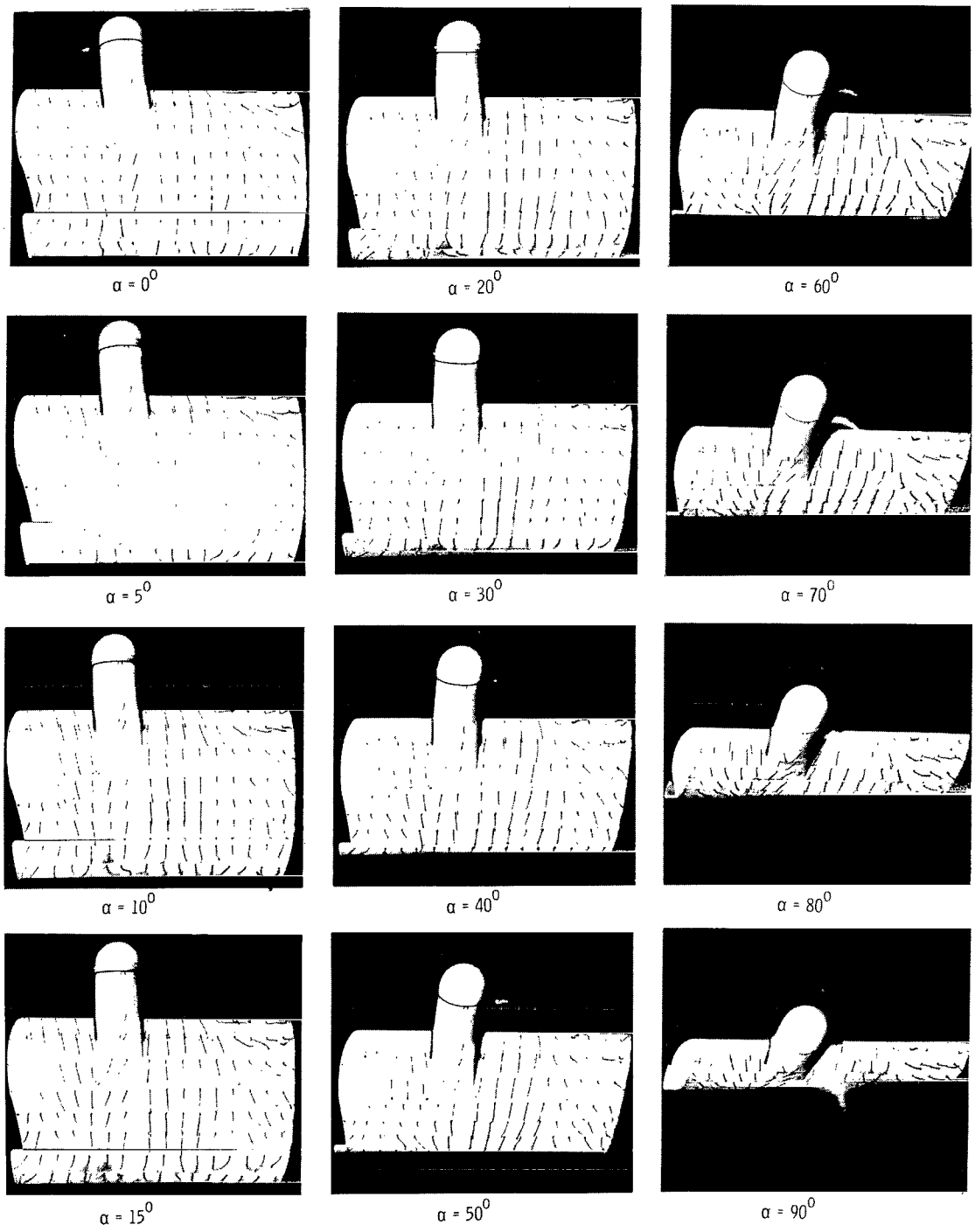
(h) Flow characteristics; $C_{T,s} = 0$. L-63-7547

Figure 6.- Concluded.



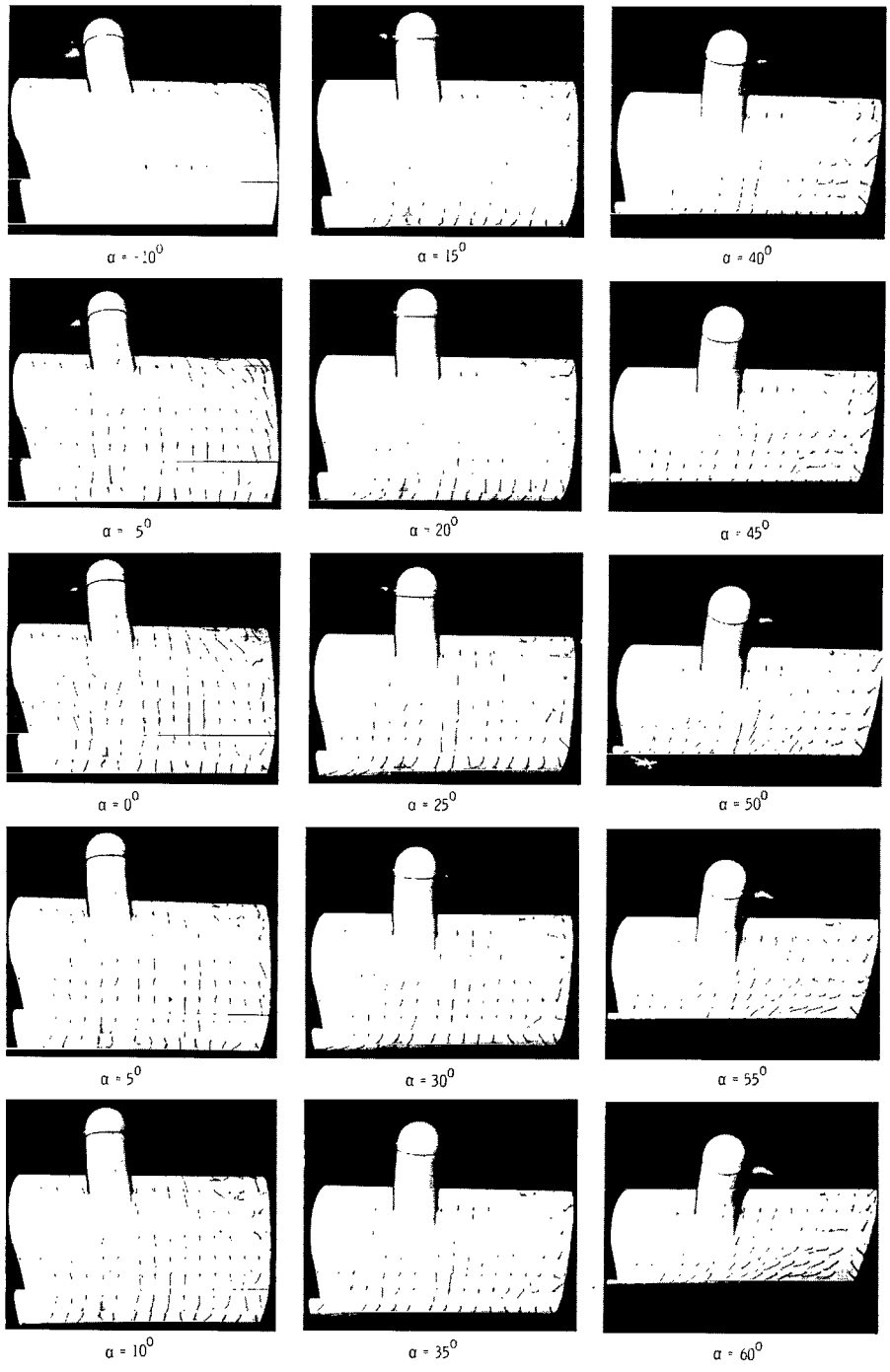
(a) Aerodynamic characteristics.

Figure 7.- Aerodynamic and flow characteristics of the model with basic leading edge and with trailing-edge flap deflected. $\delta_f = 50^\circ$.



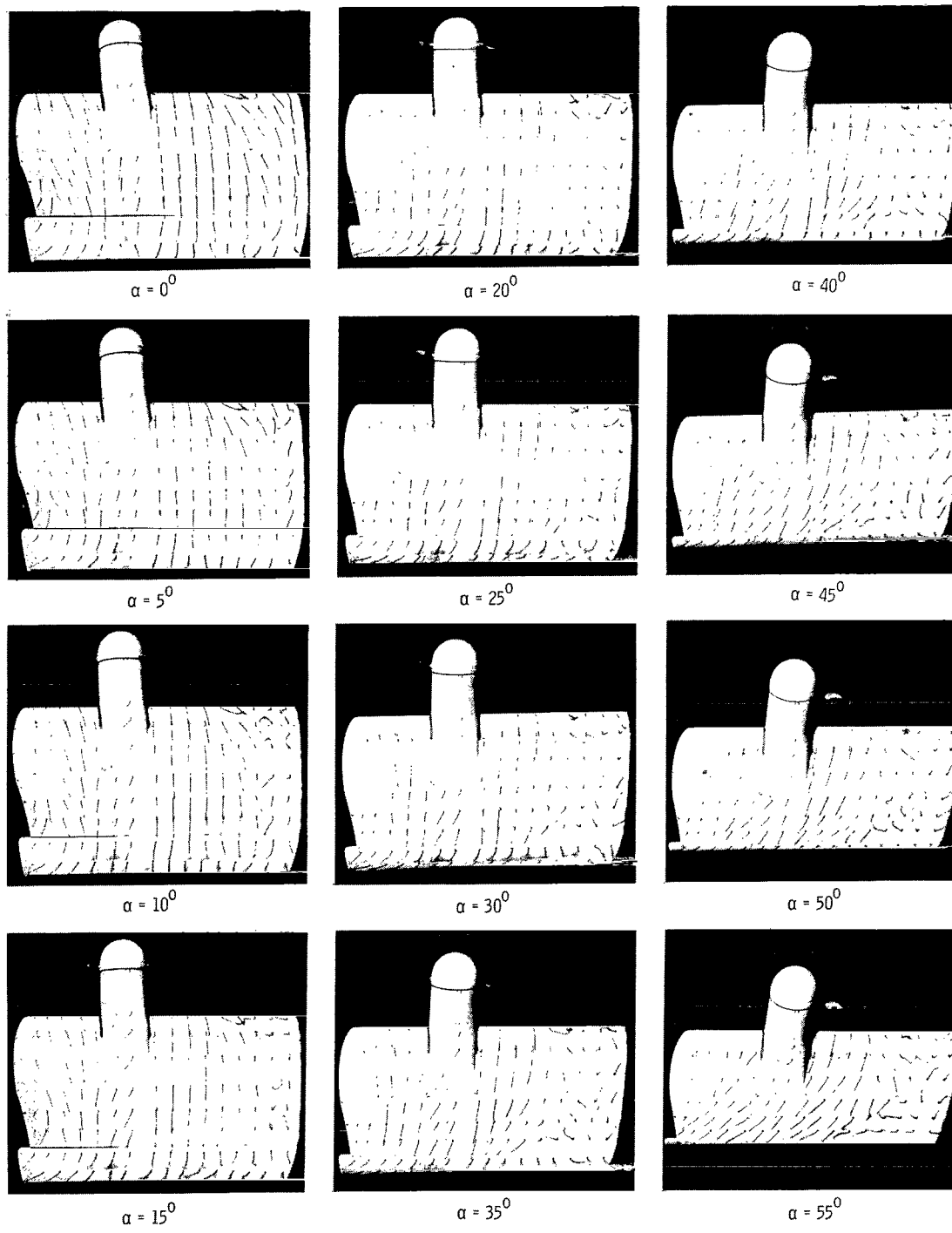
(b) Flow characteristics; $C_{T,s}$ = 1.00. L-63-7548

Figure 7.- Continued.



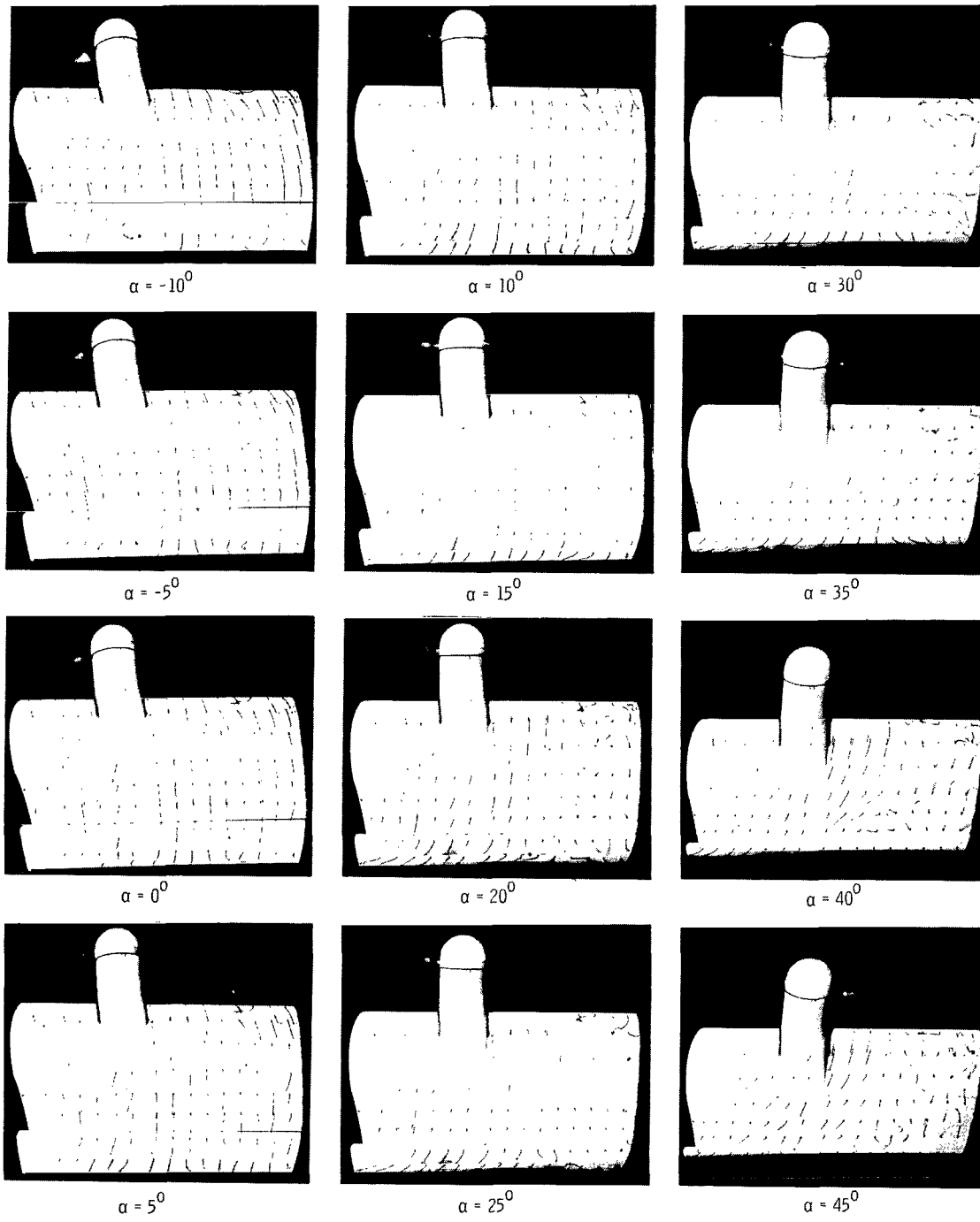
(c) Flow characteristics; $C_{T,s} = 0.95$. L-63-7549

Figure 7.- Continued.



(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7550

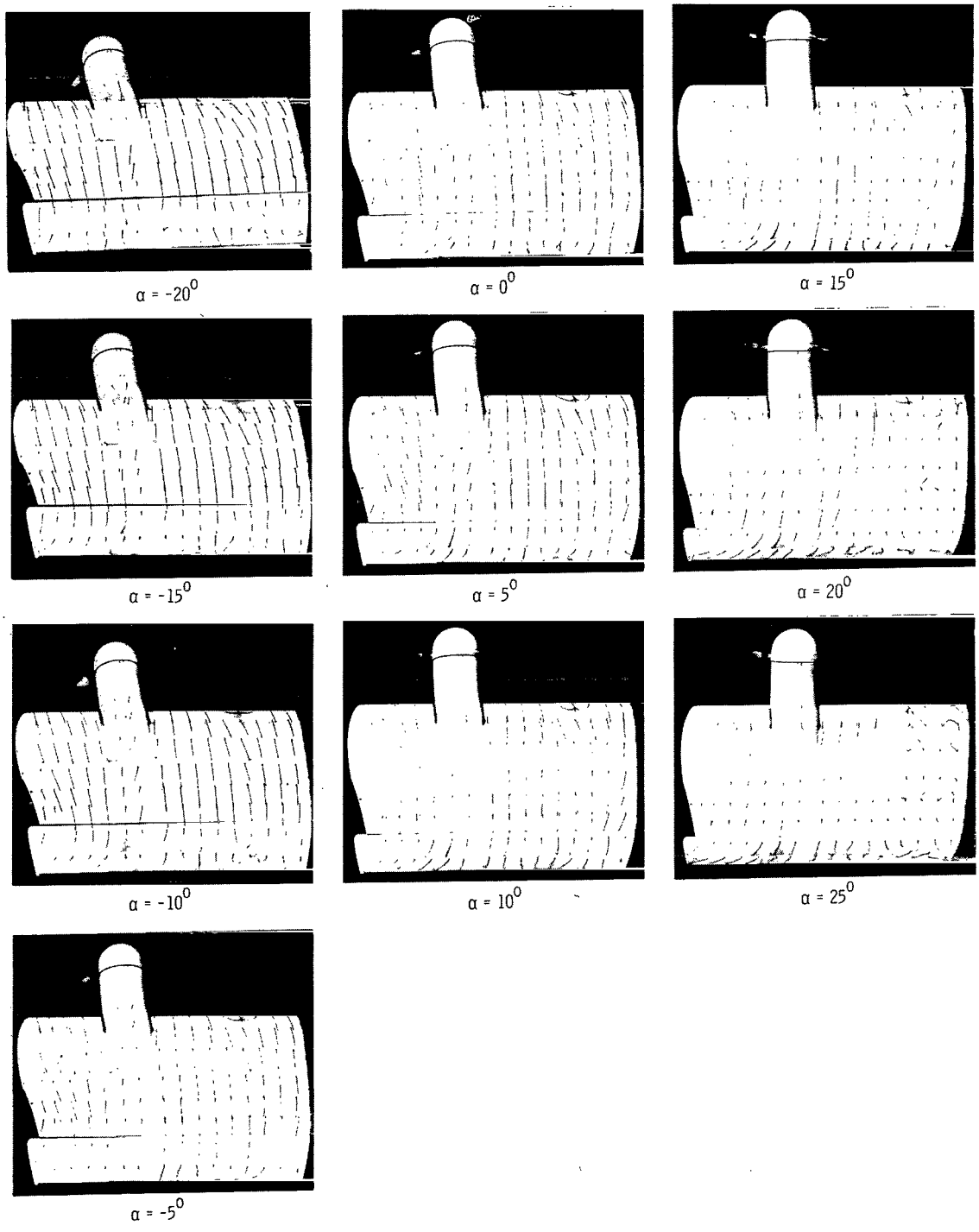
Figure 7.- Continued.



(e) Flow characteristics; $C_{T,s} = 0.80$.

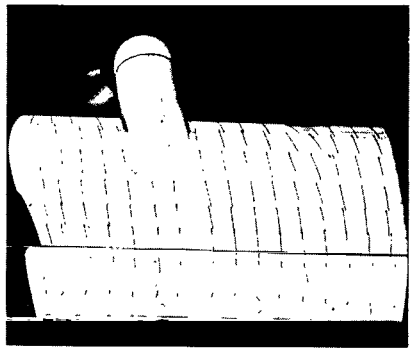
L-63-7551

Figure 7.- Continued.



(f) Flow characteristics; $C_{T,s} = 0.60$. L-63-7552

Figure 7.- Continued.



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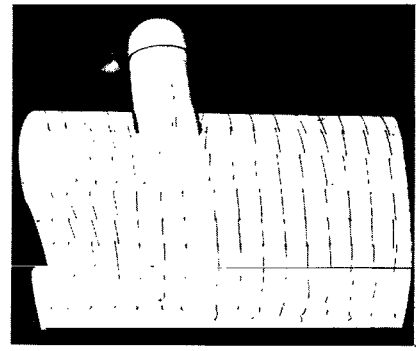

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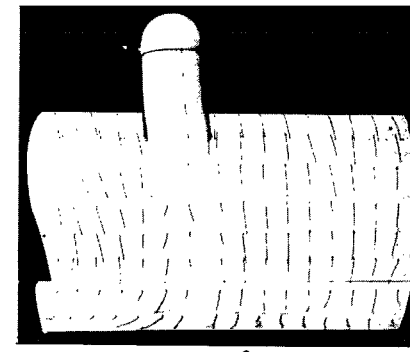

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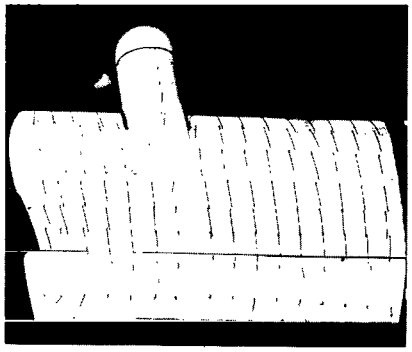

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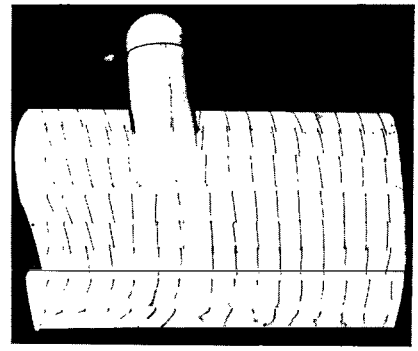

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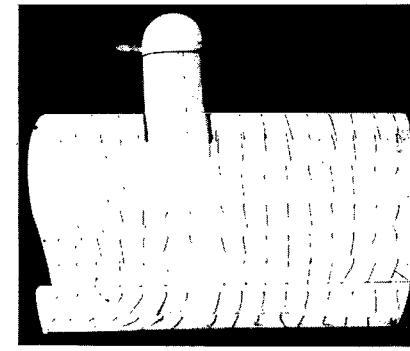

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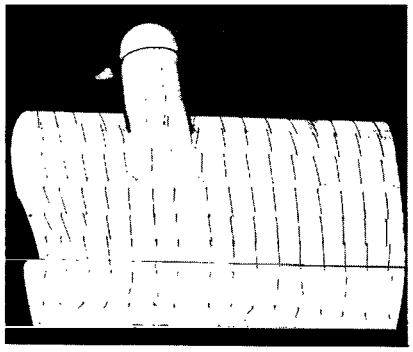

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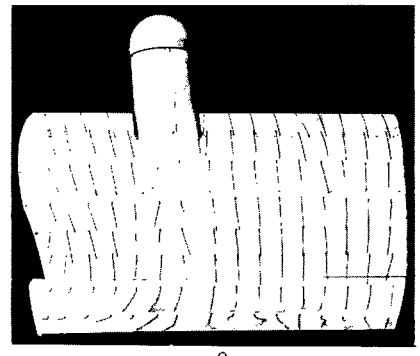

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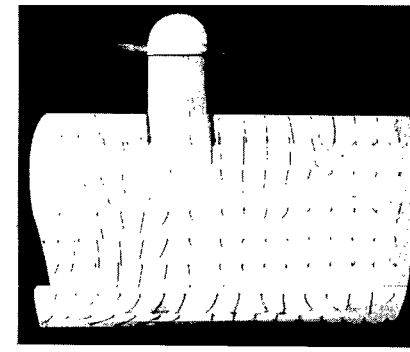
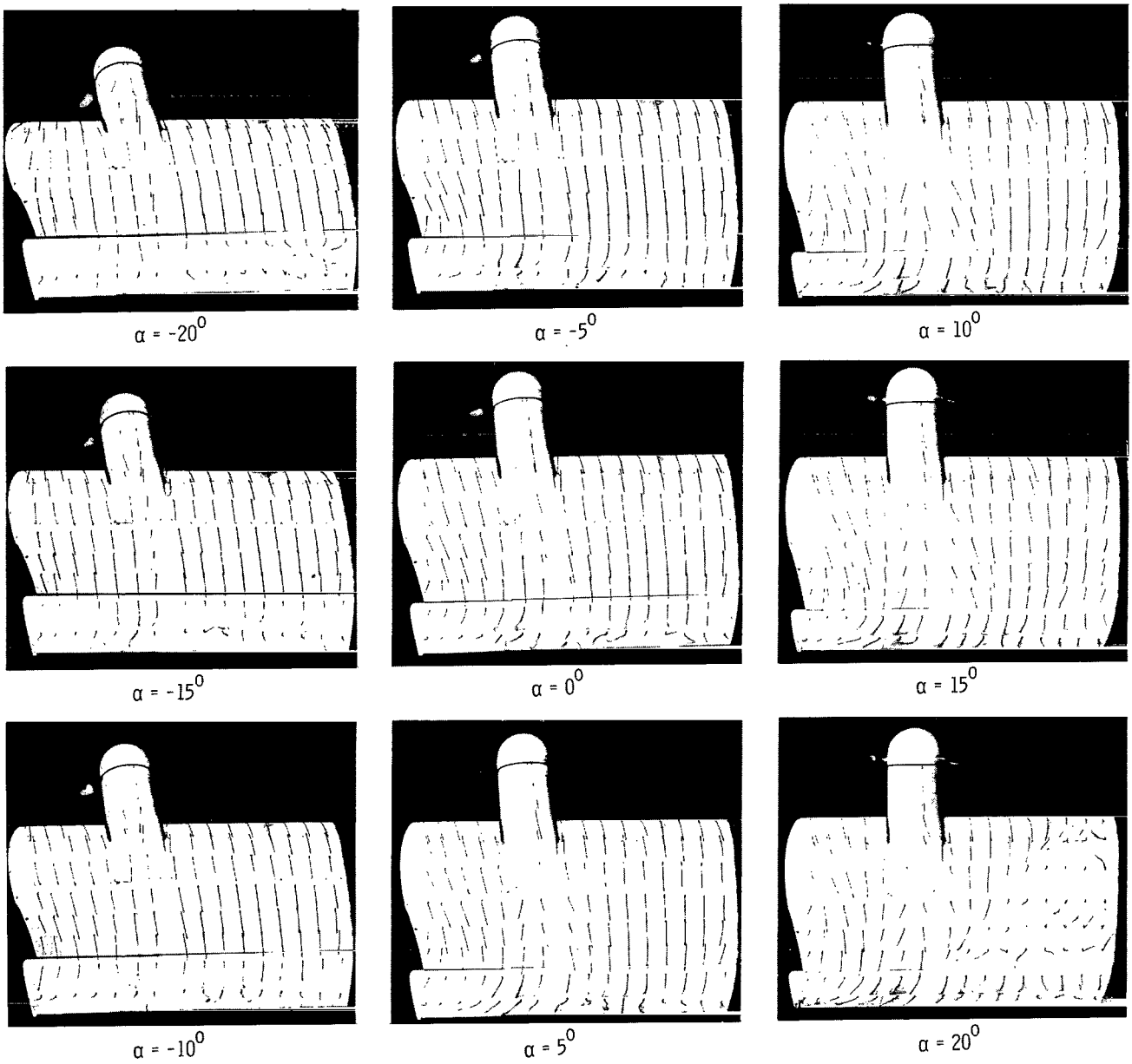


$\alpha = 20^0$

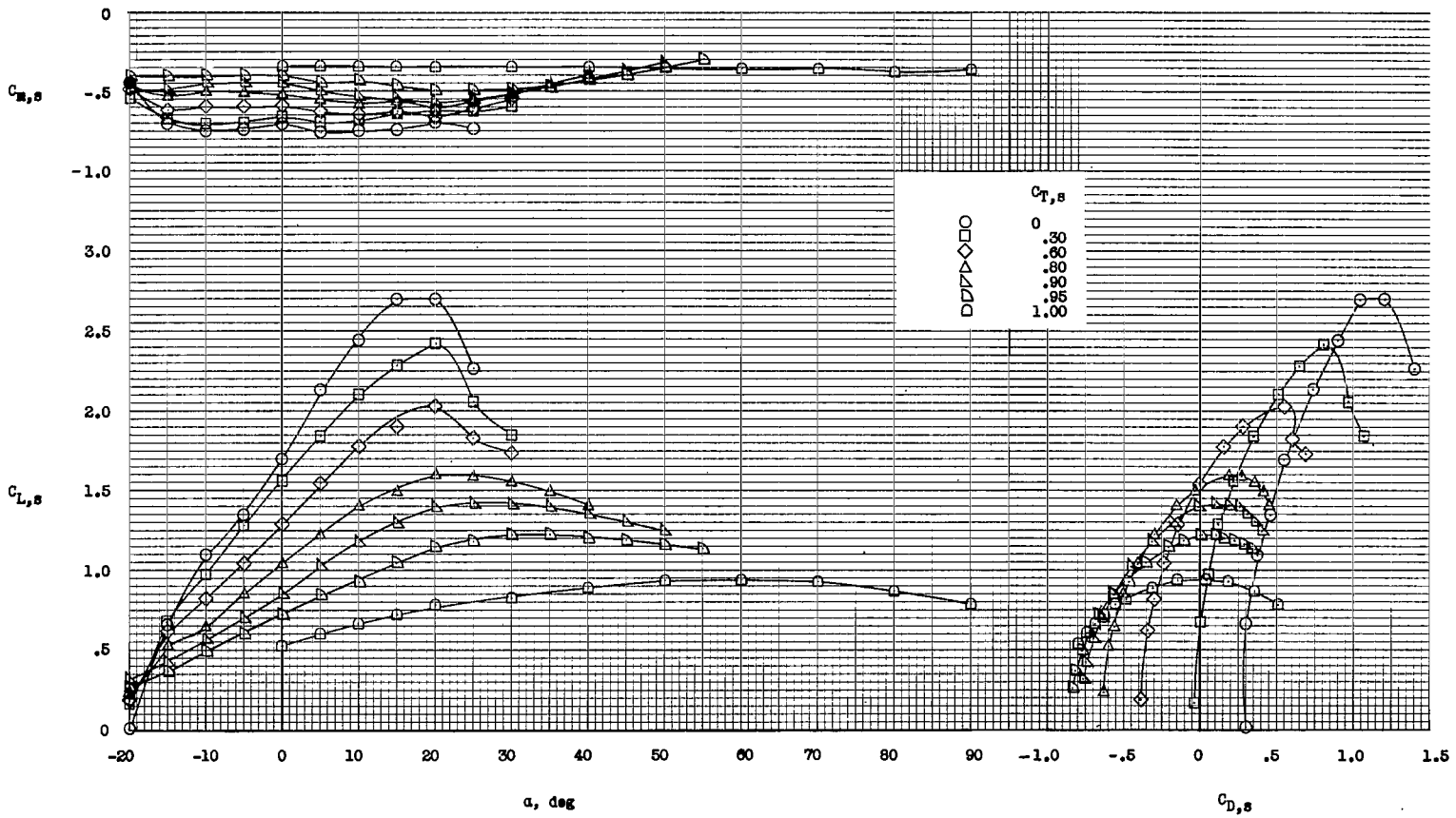
(g) Flow characteristics; $C_{T,s} = 0.30$. L-63-7553

Figure 7.- Continued.



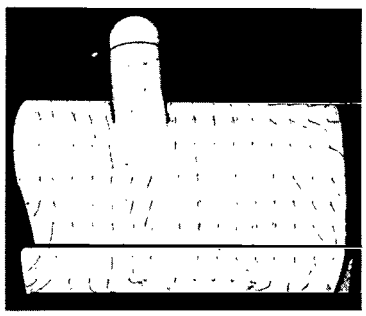
(h) Flow characteristics; $C_{T,s} = 0$. L-63-7554

Figure 7.- Concluded.



(a) Aerodynamic characteristics.

Figure 8.- Aerodynamic and flow characteristics of the model with basic leading edge and with trailing-edge flap deflected. $\delta_f = 60^\circ$.



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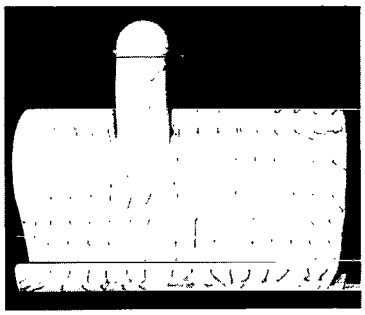

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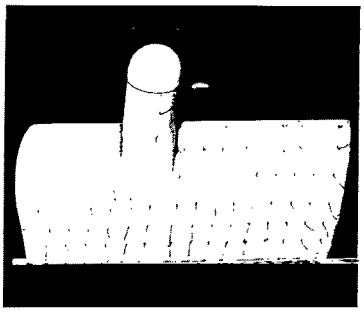

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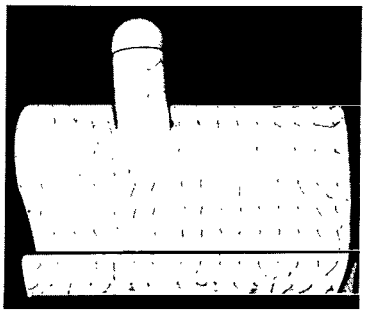

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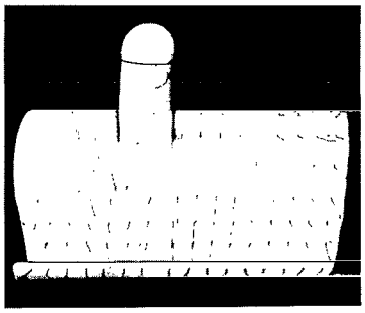

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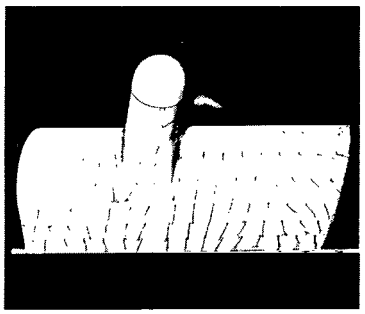
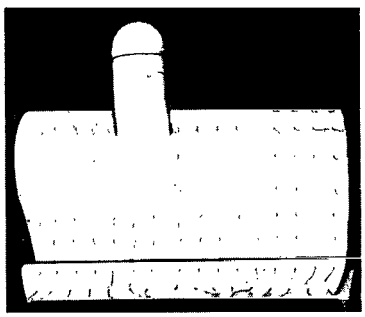


$\alpha = 60^0$



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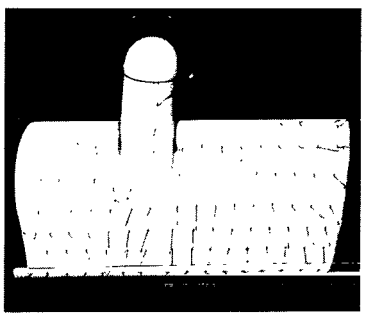

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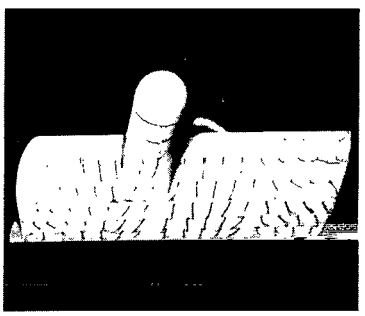

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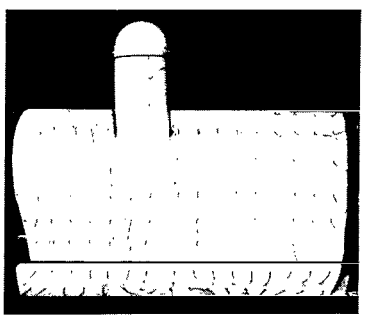
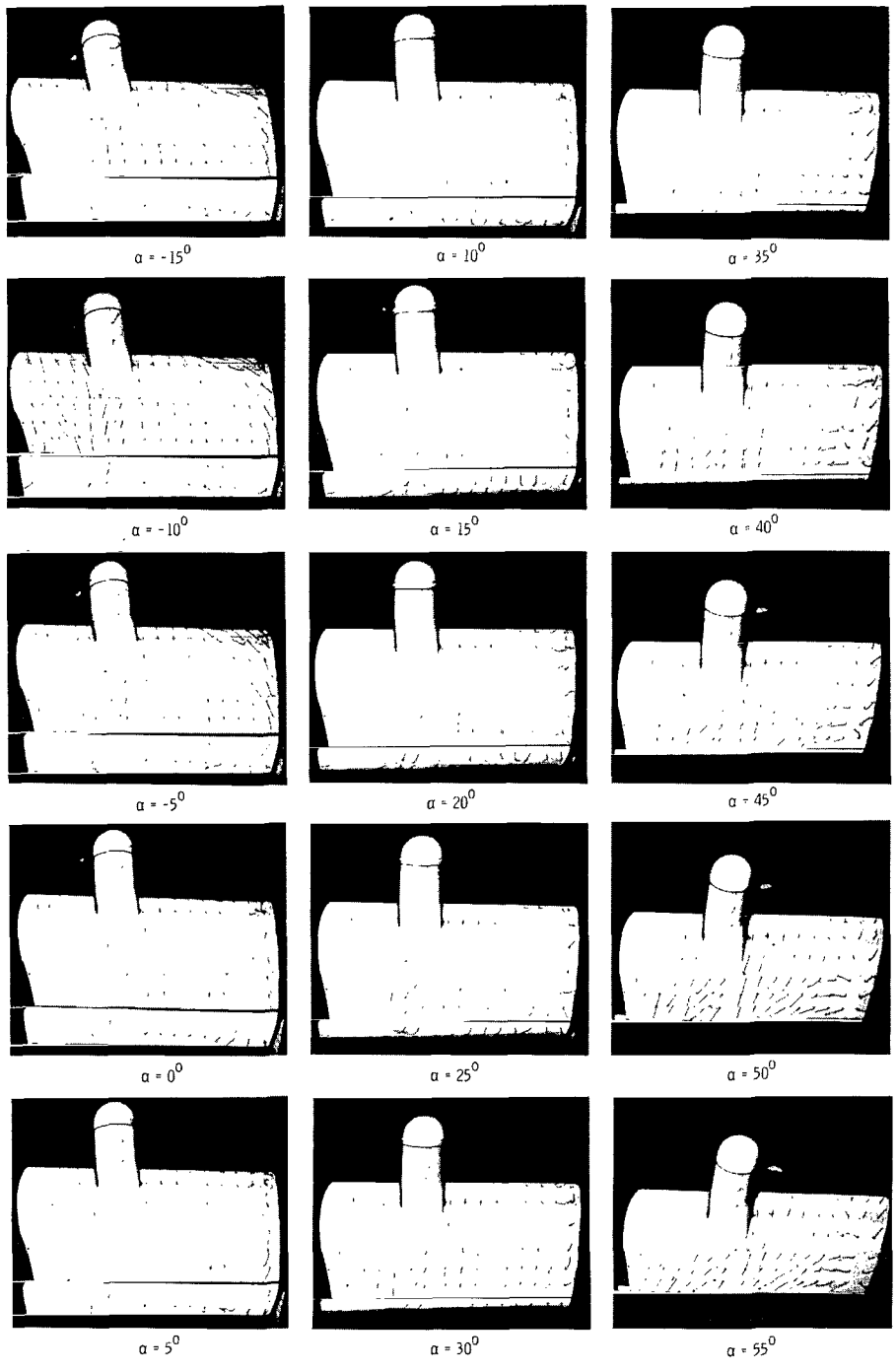


$\alpha = 15^0$

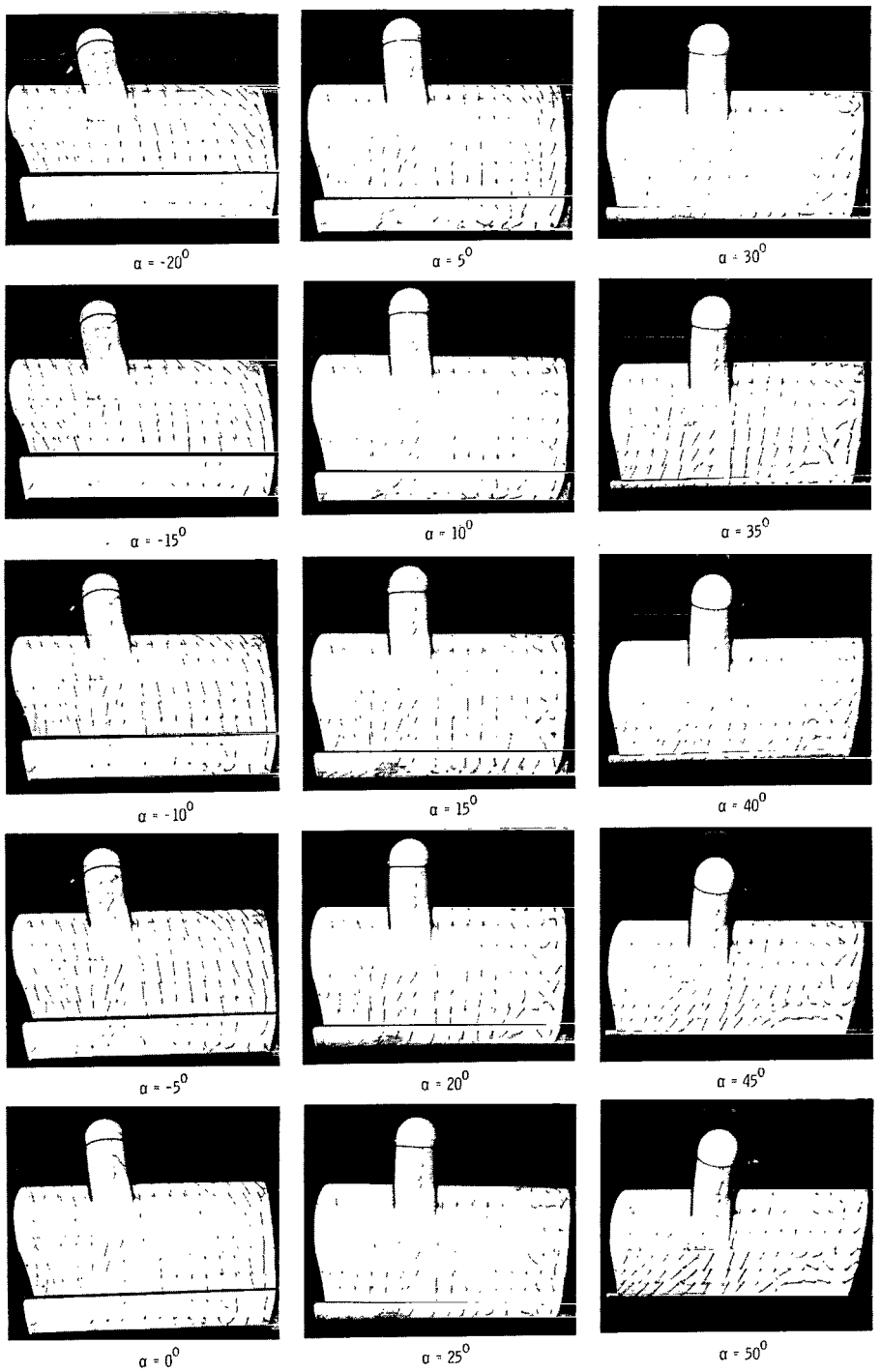
(b) Flow characteristics; $C_{T,s} = 1.00$. L-63-7555

Figure 8.- Continued.



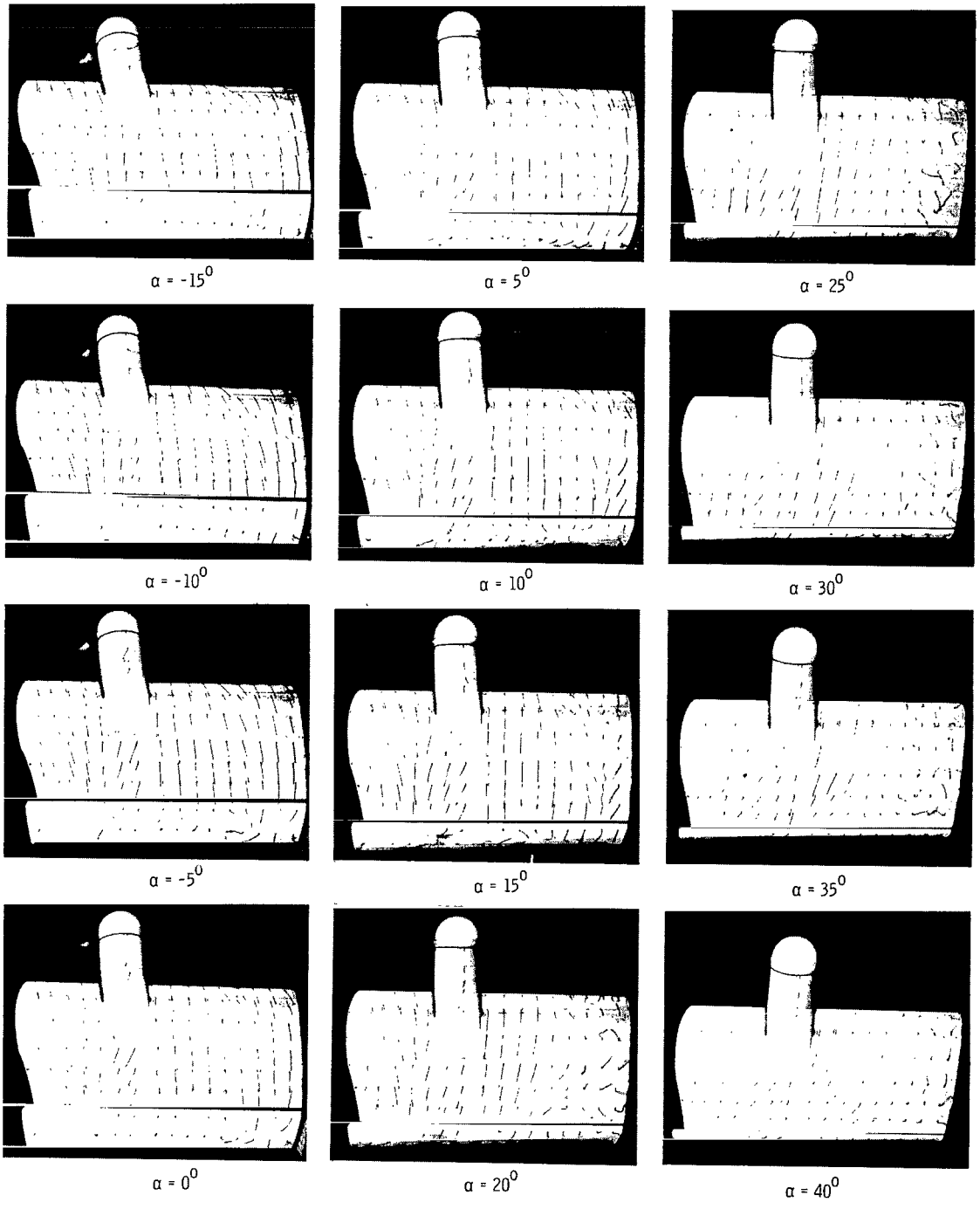
(c) Flow characteristics; $C_{T,s}$ = 0.95. L-63-7556

Figure 8.- Continued.



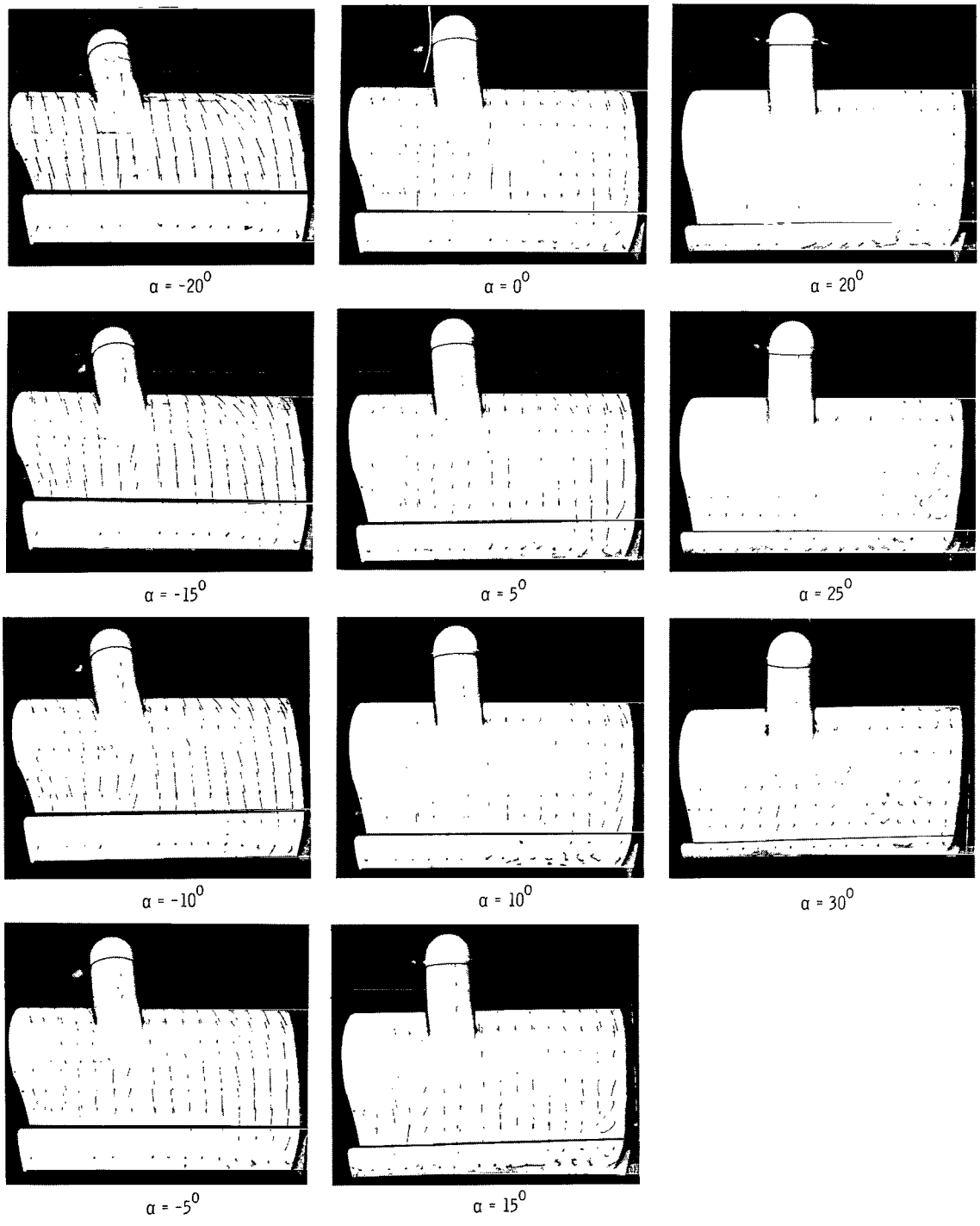
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7557

Figure 8.- Continued.



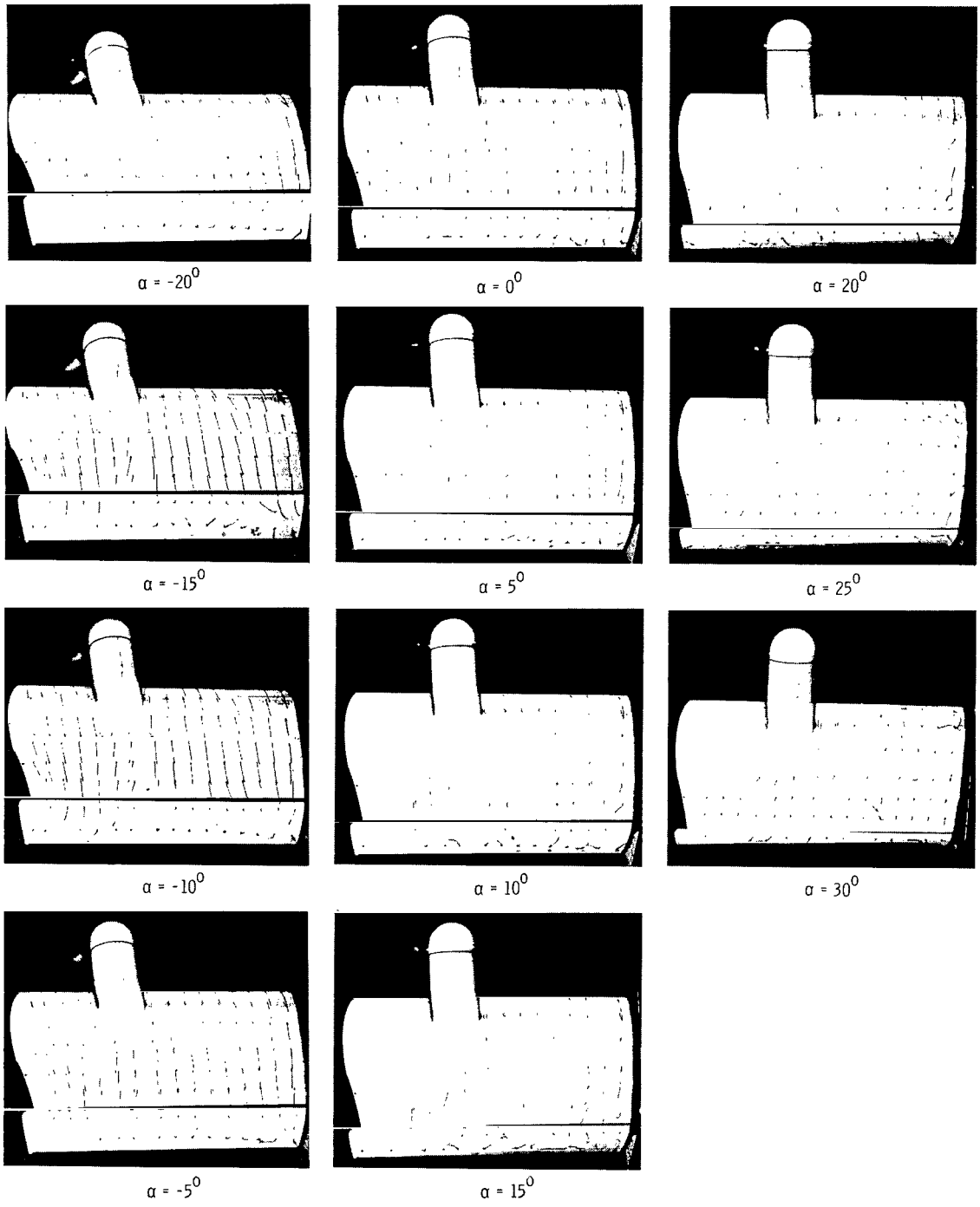
(e) Flow characteristics; $C_{T,s} = 0.80$. L-63-7558

Figure 8.- Continued.



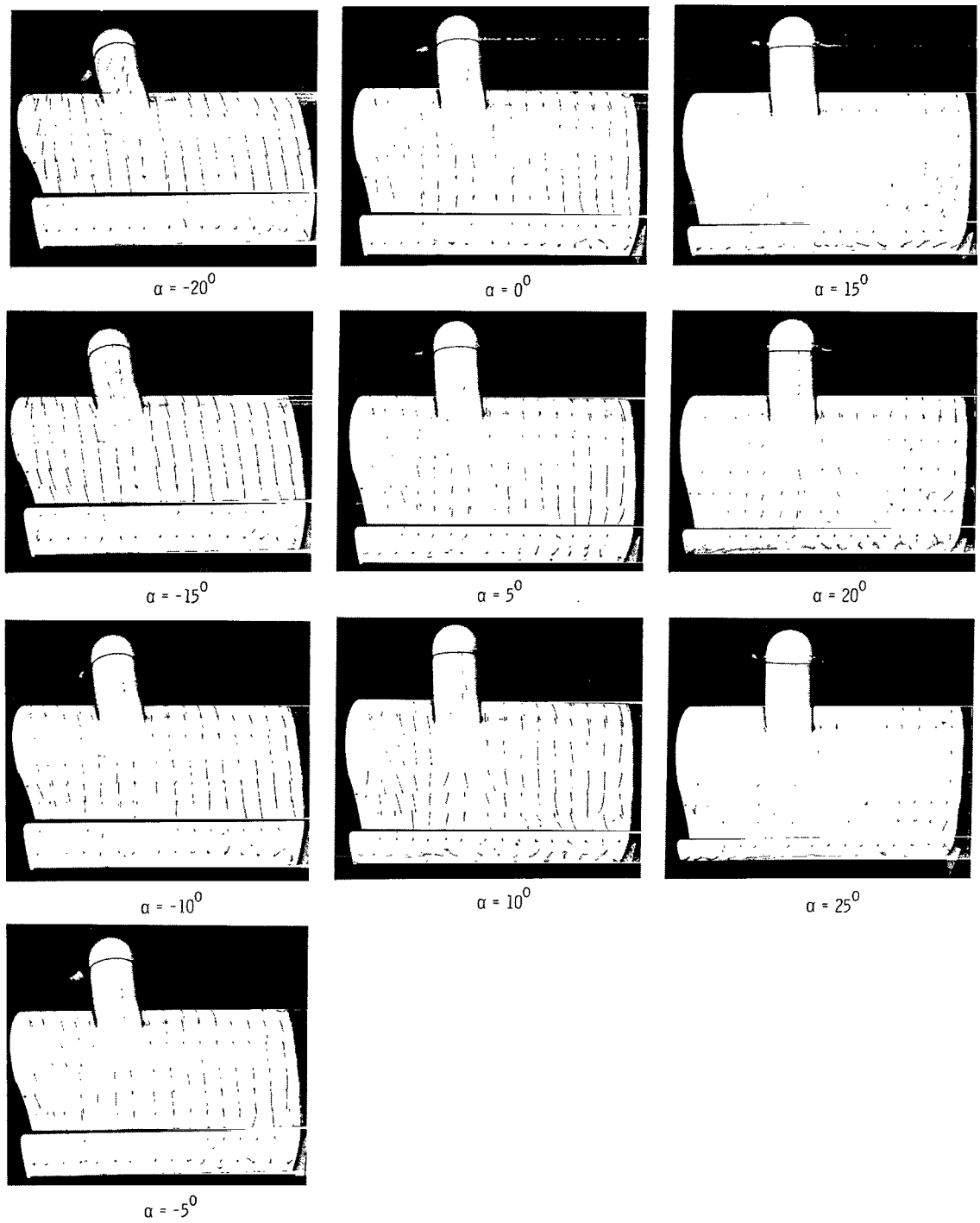
(f) Flow characteristics; $C_{T,s} = 0.60$. L-63-7559

Figure 8.- Continued.



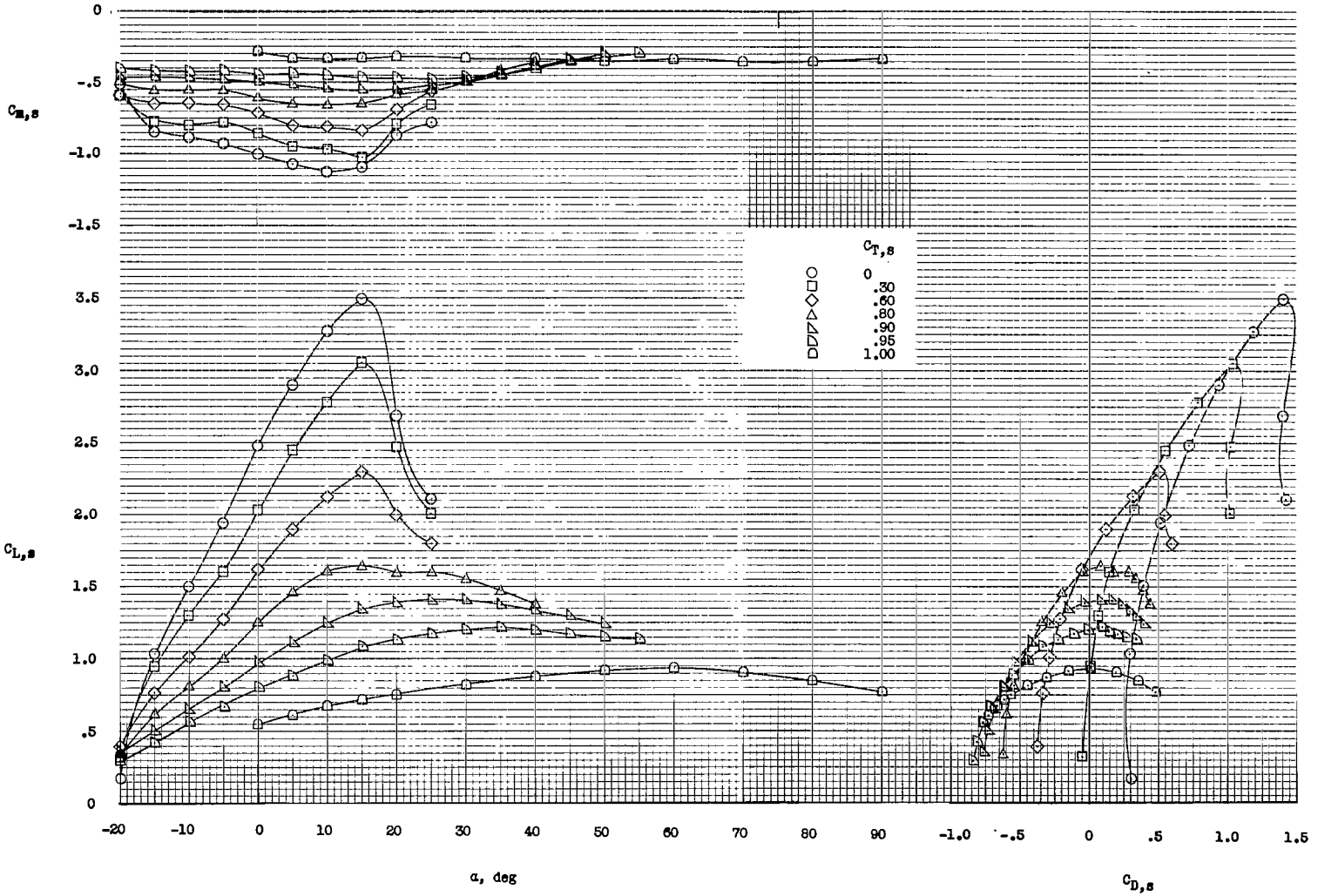
(g) Flow characteristics; $C_{T,s}$ = 0.30. L-63-7560

Figure 8.- Continued.



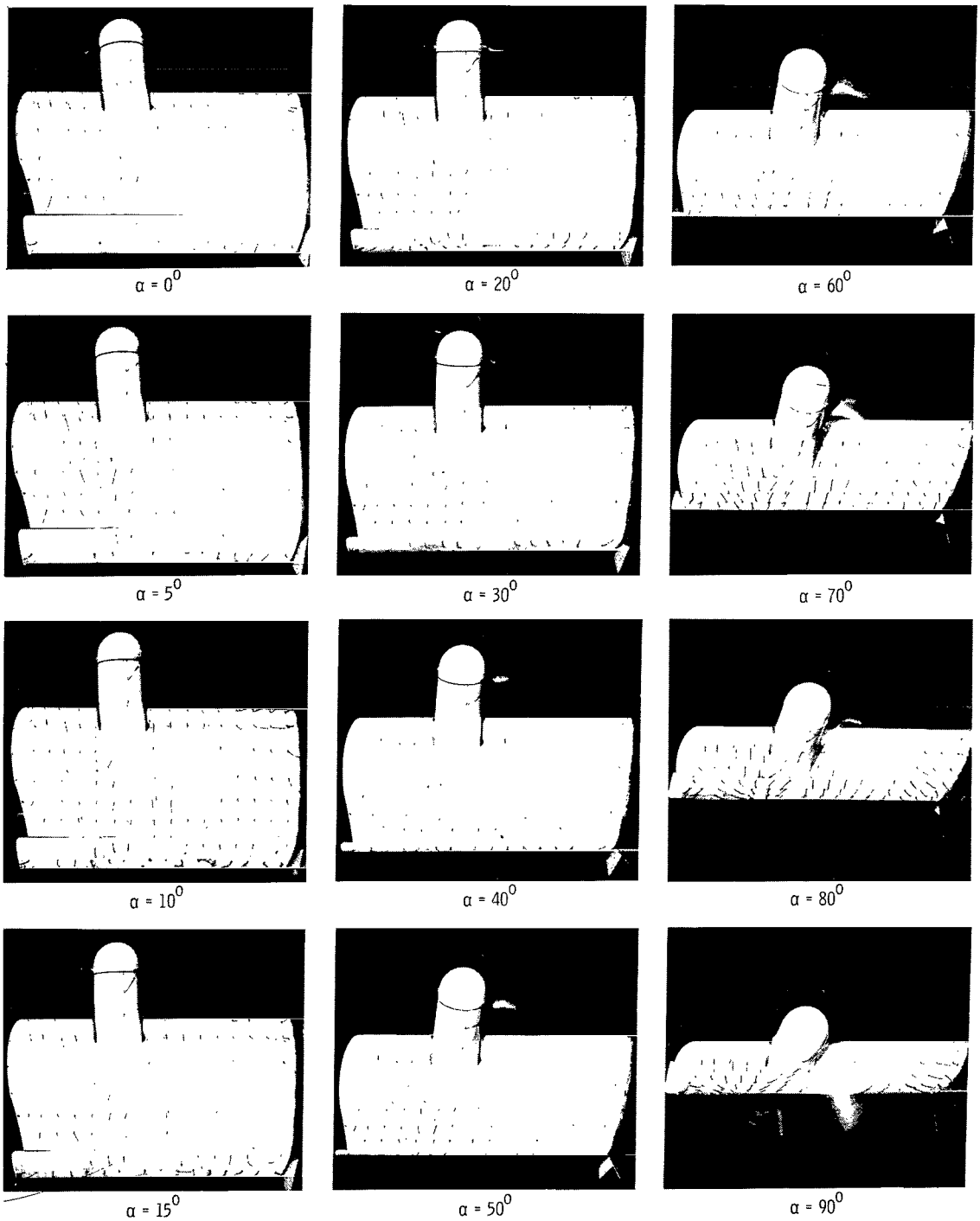
(h) Flow characteristics; $C_{T,s} = 0$. L-63-7561

Figure 8.- Concluded.



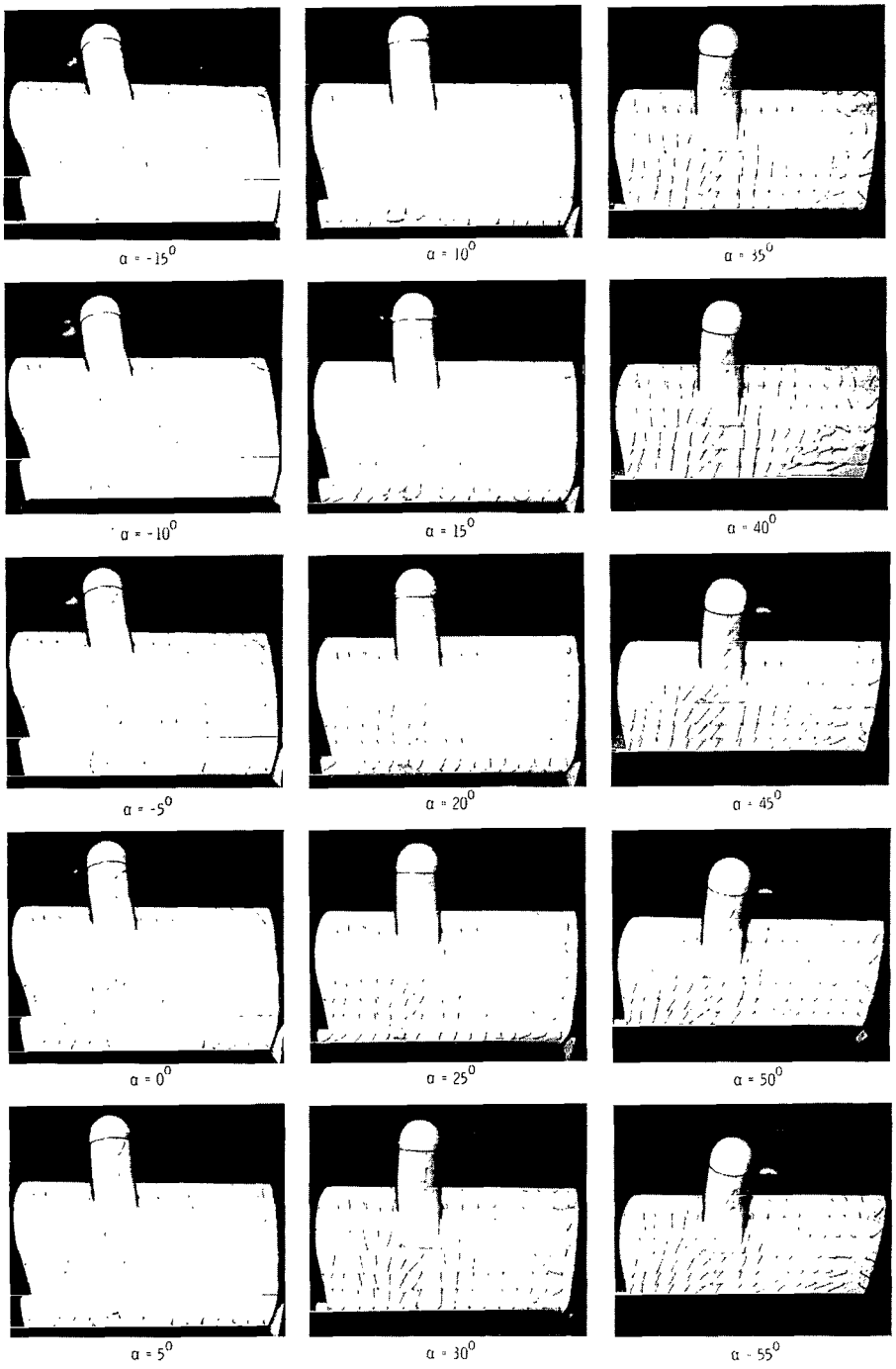
(a) Aerodynamic characteristics.

Figure 9.- Aerodynamic and flow characteristics of the model with basic leading edge and with trailing-edge flap deflected. $\delta_f = 60^\circ$; alternate hinge point.



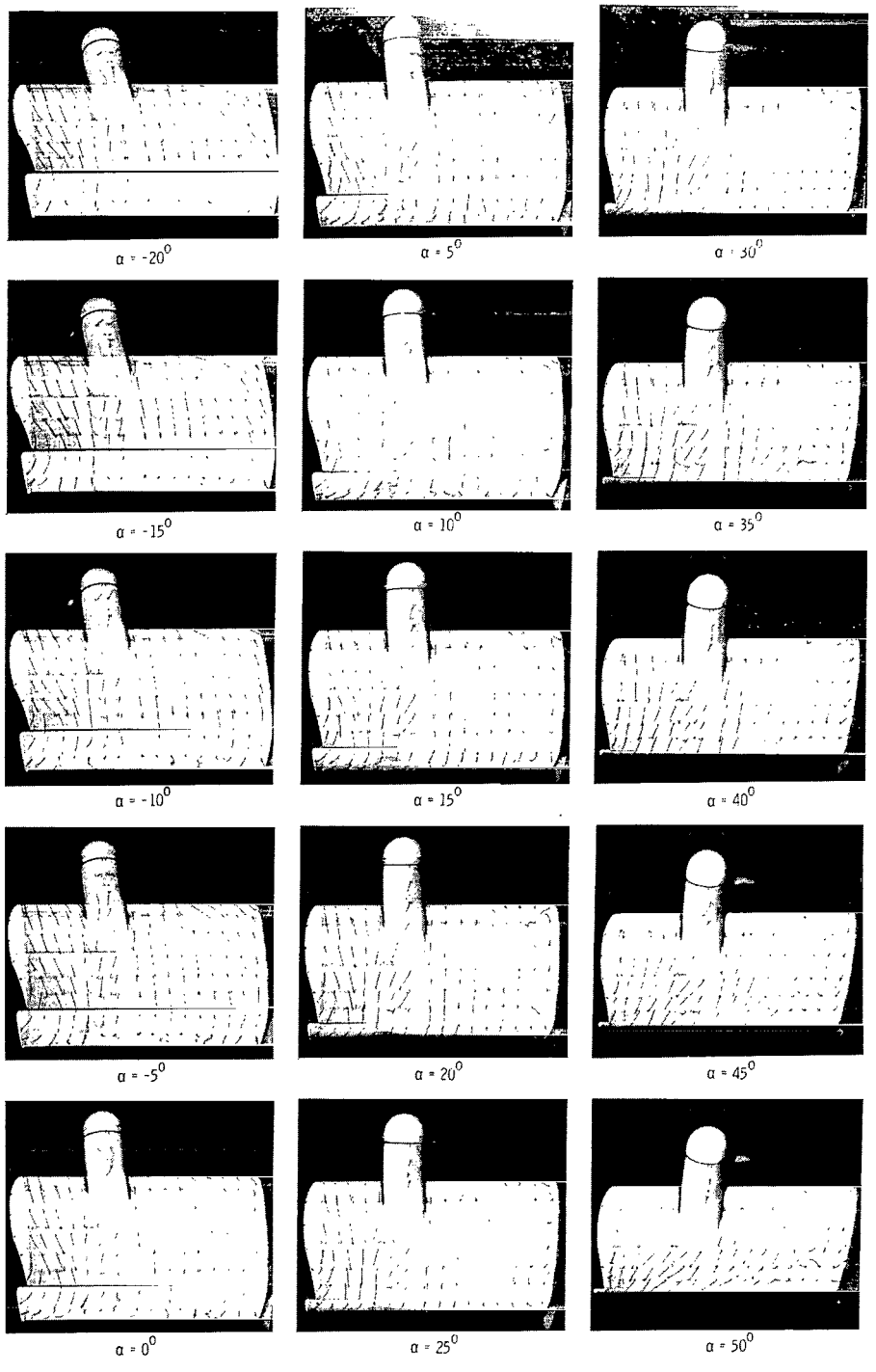
(b) Flow characteristics; $C_{T,S}$ = 1.00. L-63-7562

Figure 9.- Continued.



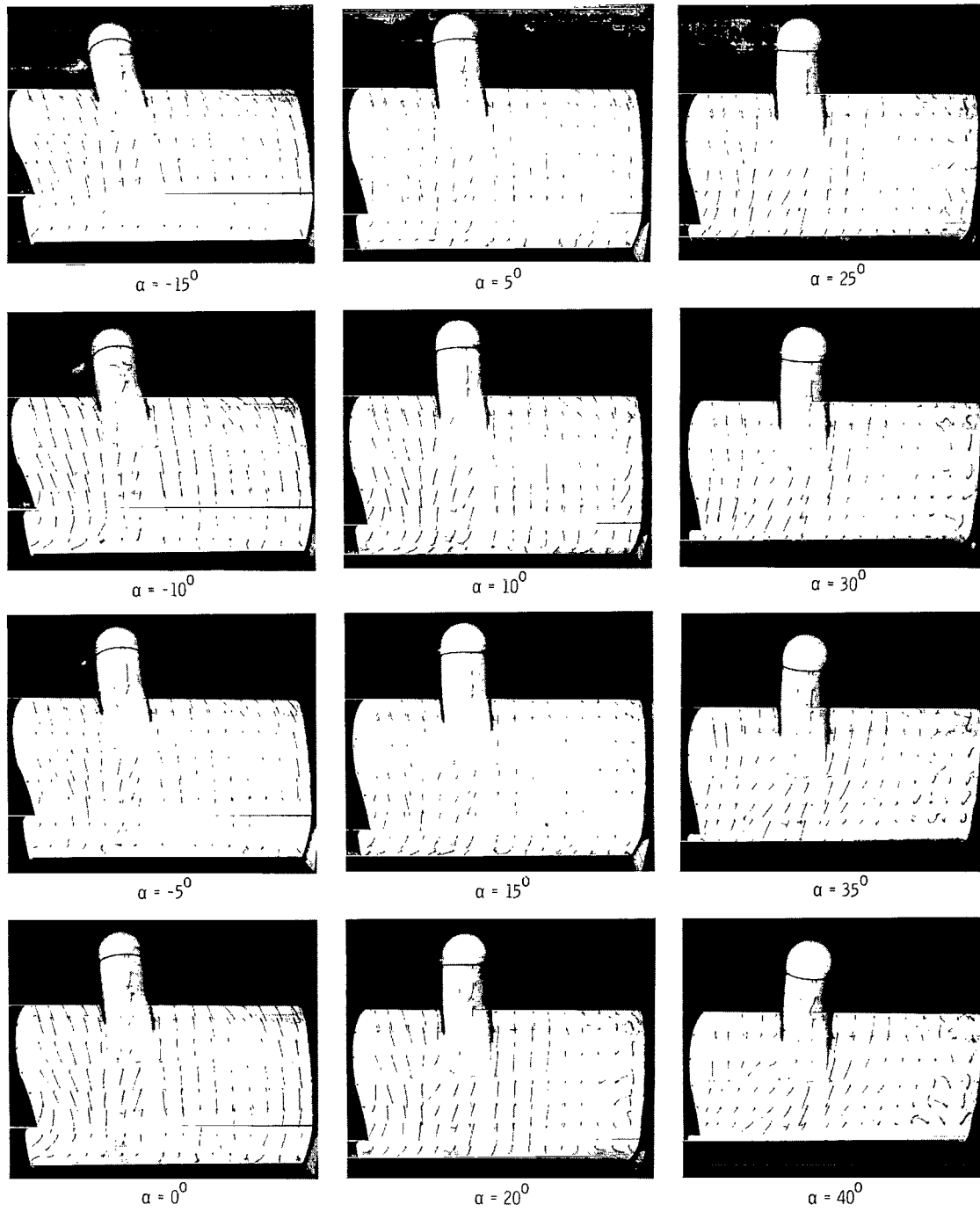
(c) Flow characteristics; $C_{T,s}$ = 0.95. L-63-7563

Figure 9.- Continued.



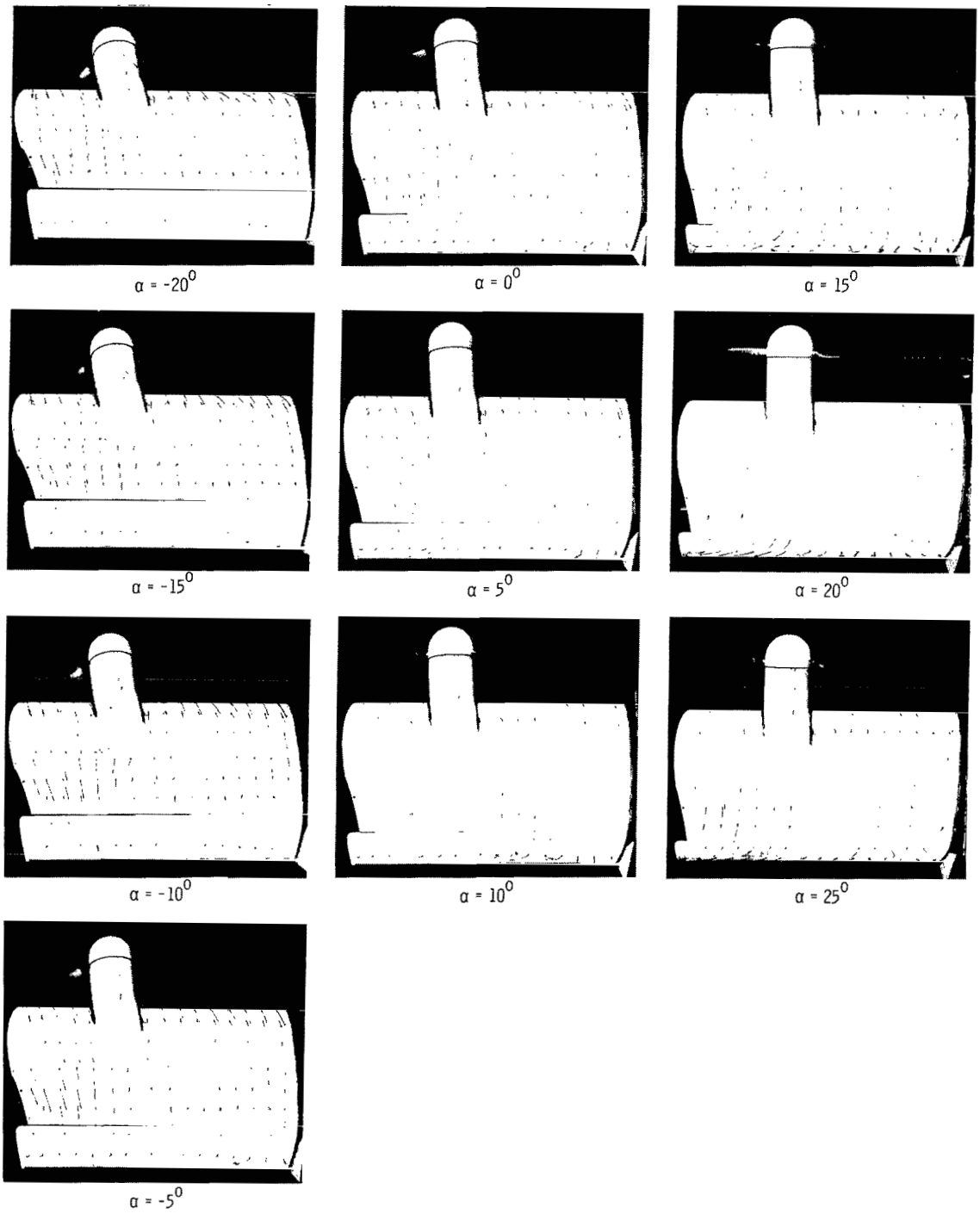
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7564

Figure 9.- Continued.



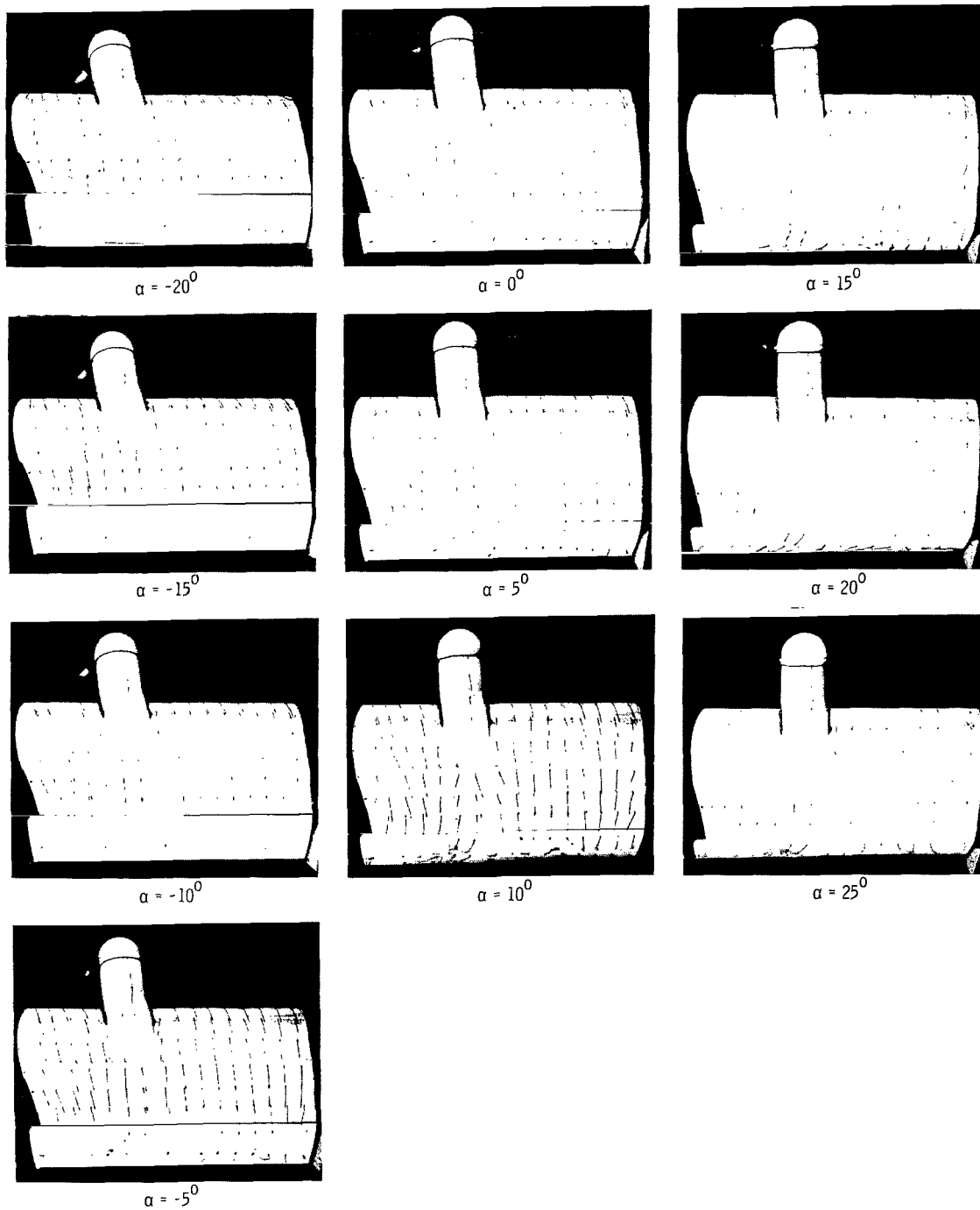
(e) Flow characteristics; $C_{T,s}$ = 0.80. L-63-7565

Figure 9.- Continued.



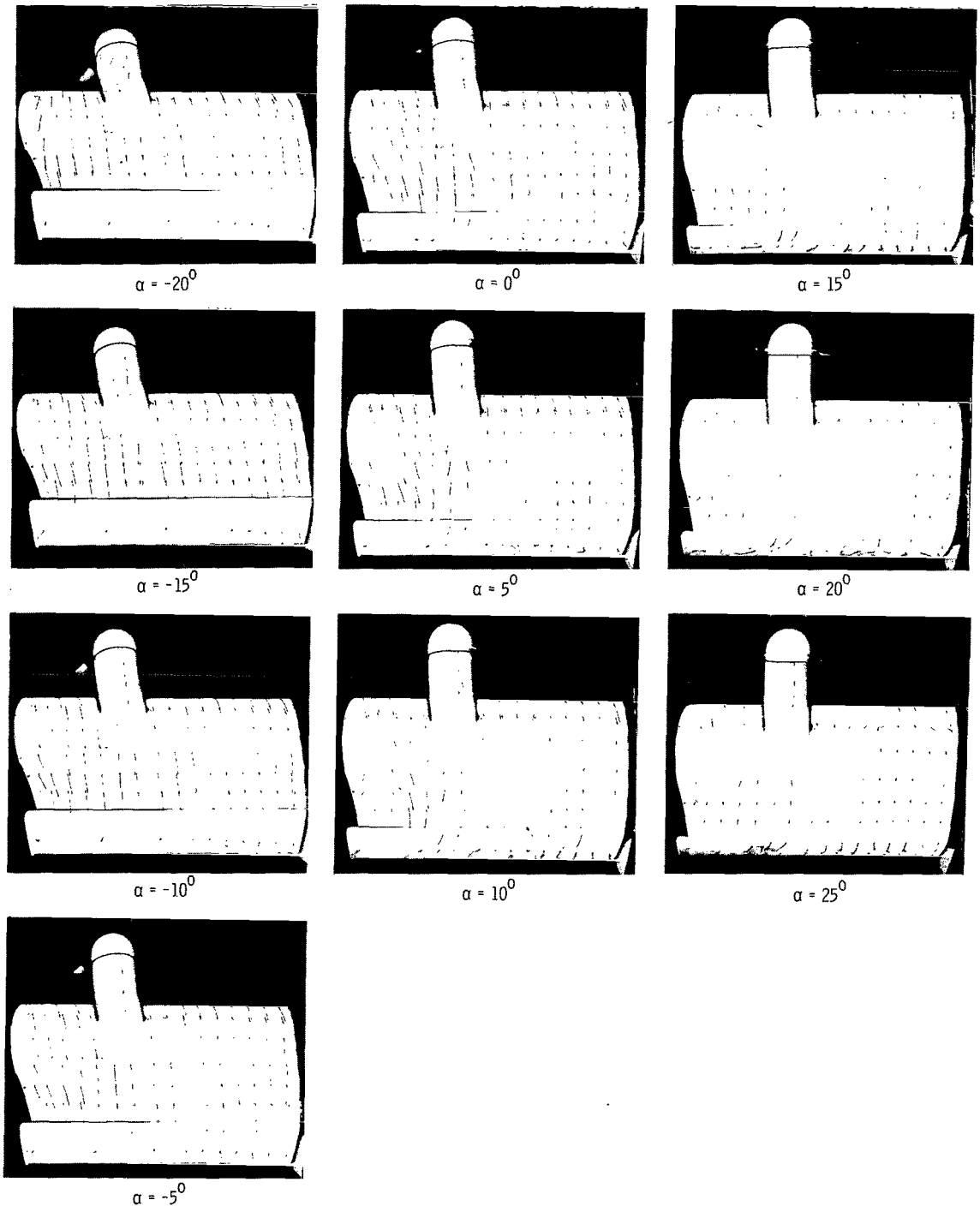
(f) Flow characteristics; $C_{T,s}$ = 0.60. L-63-7566

Figure 9.- Continued.



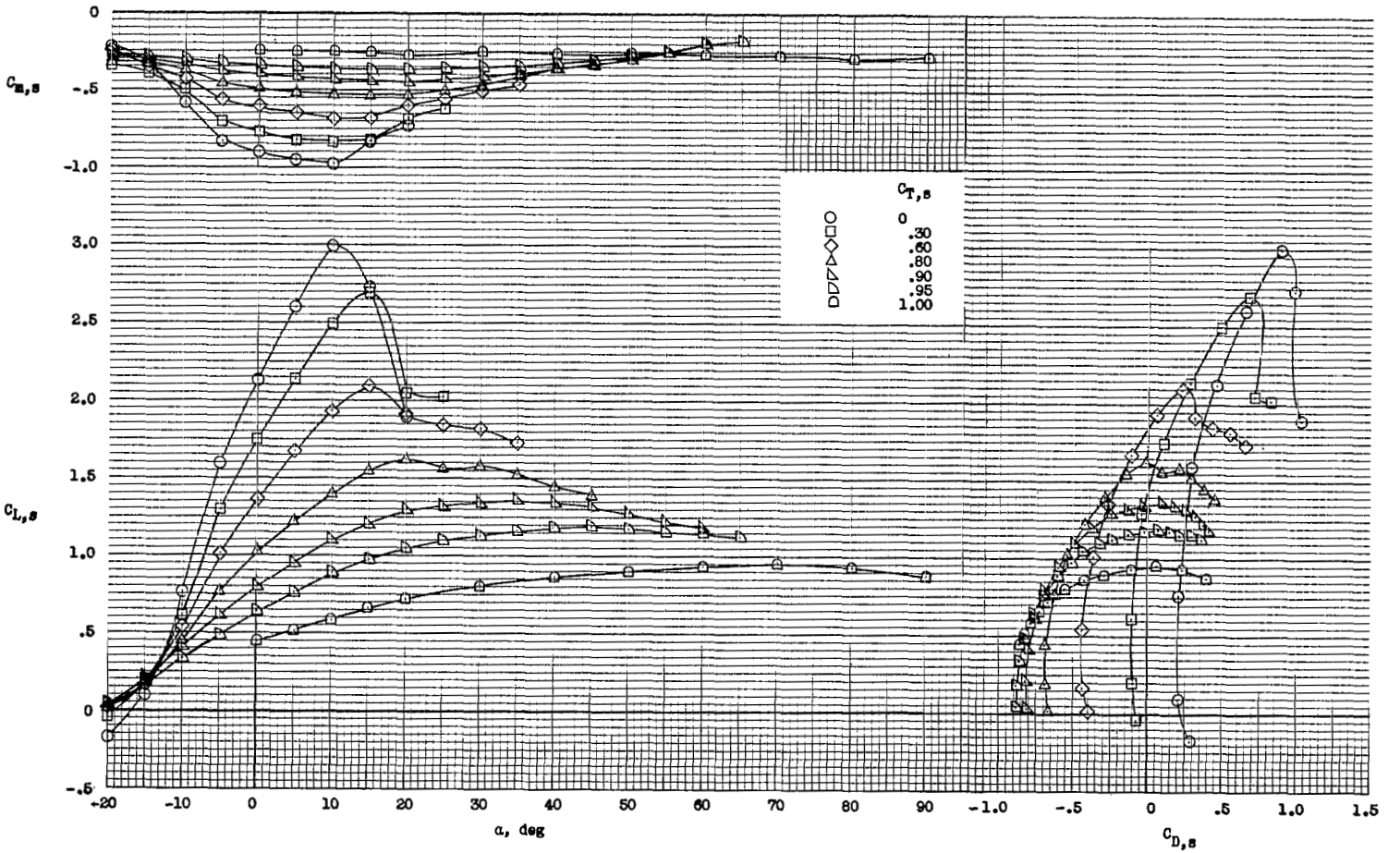
(g) Flow characteristics; $C_{T,s}$ = 0.30. L-63-7567

Figure 9.- Continued.



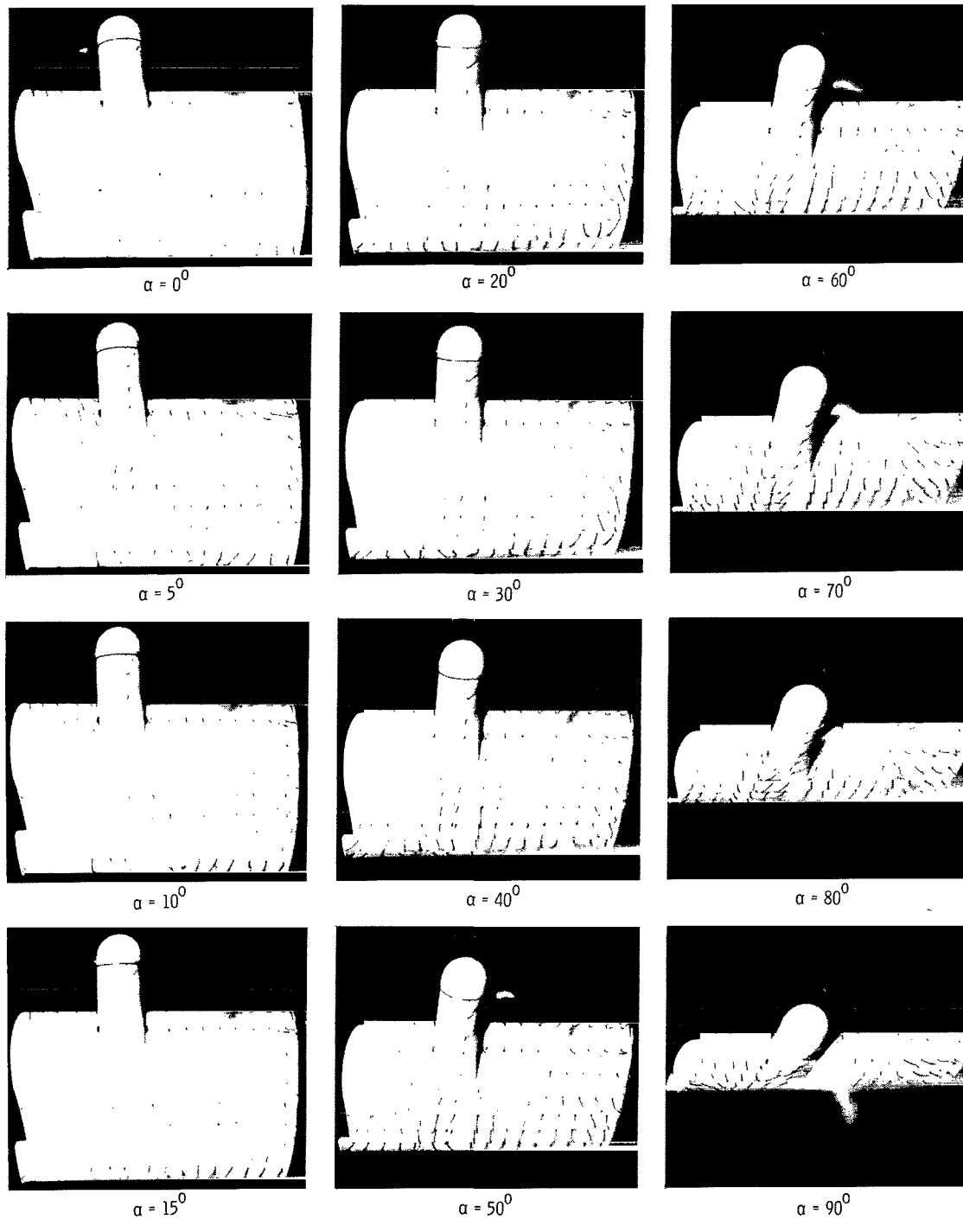
(h) Flow characteristics; $C_{T,s} = 0$. L-63-7568

Figure 9.- Concluded.



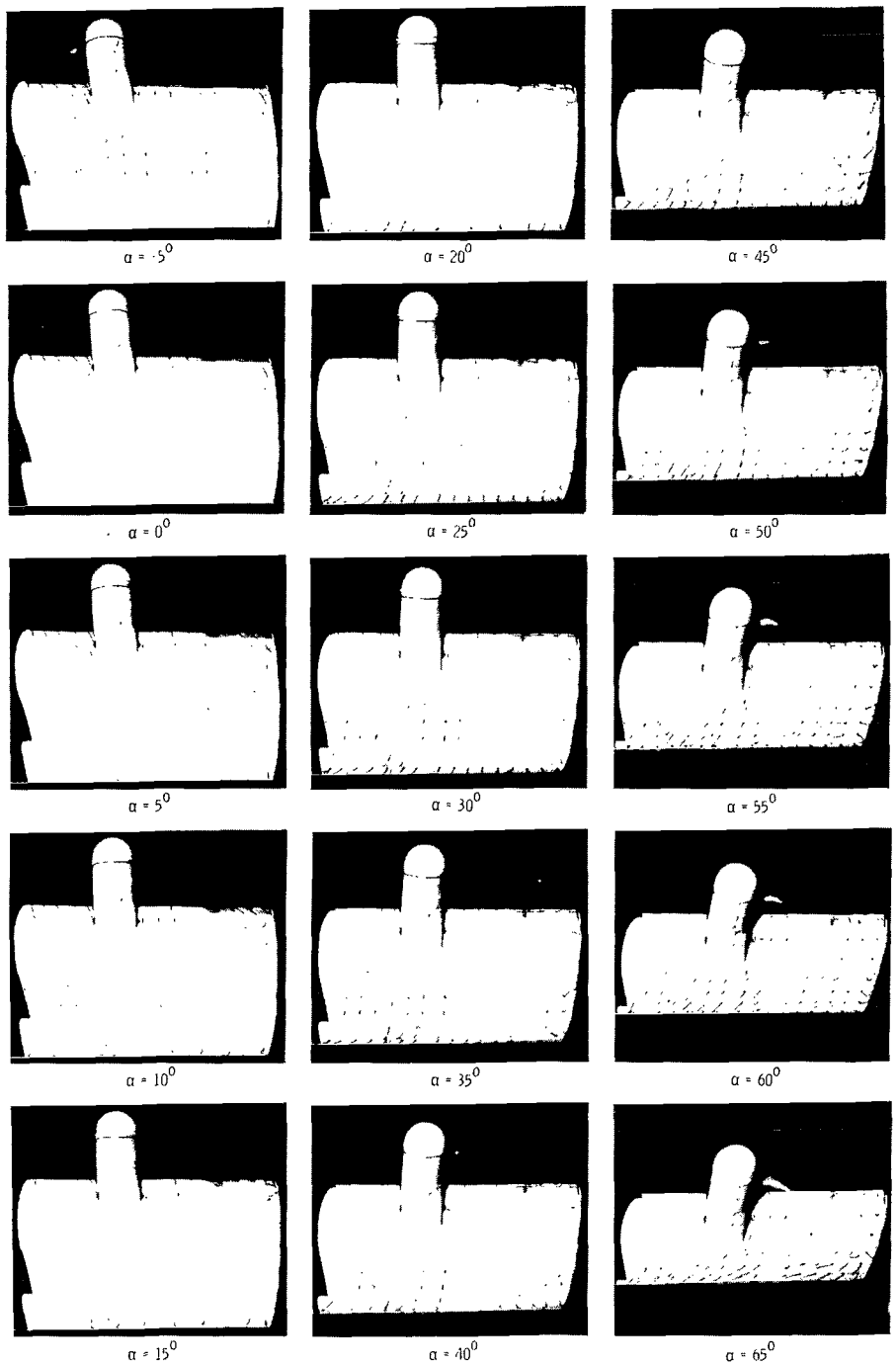
(a) Aerodynamic characteristics.

Figure 10.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 40° and leading-edge droop deflected 20°.



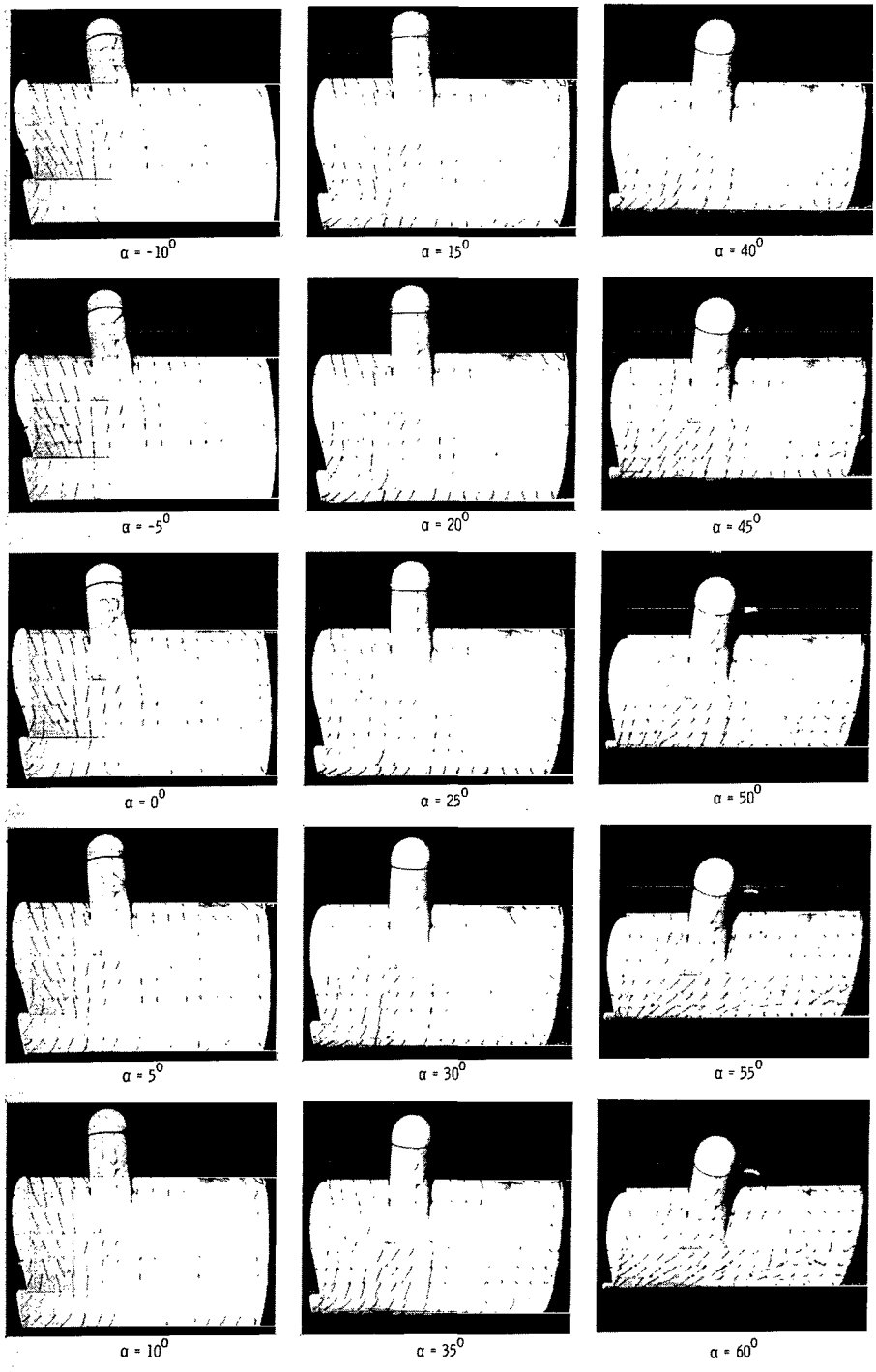
(b) Flow characteristics; $C_{T,s}$ = 1.00. L-63-7569

Figure 10.- Continued.



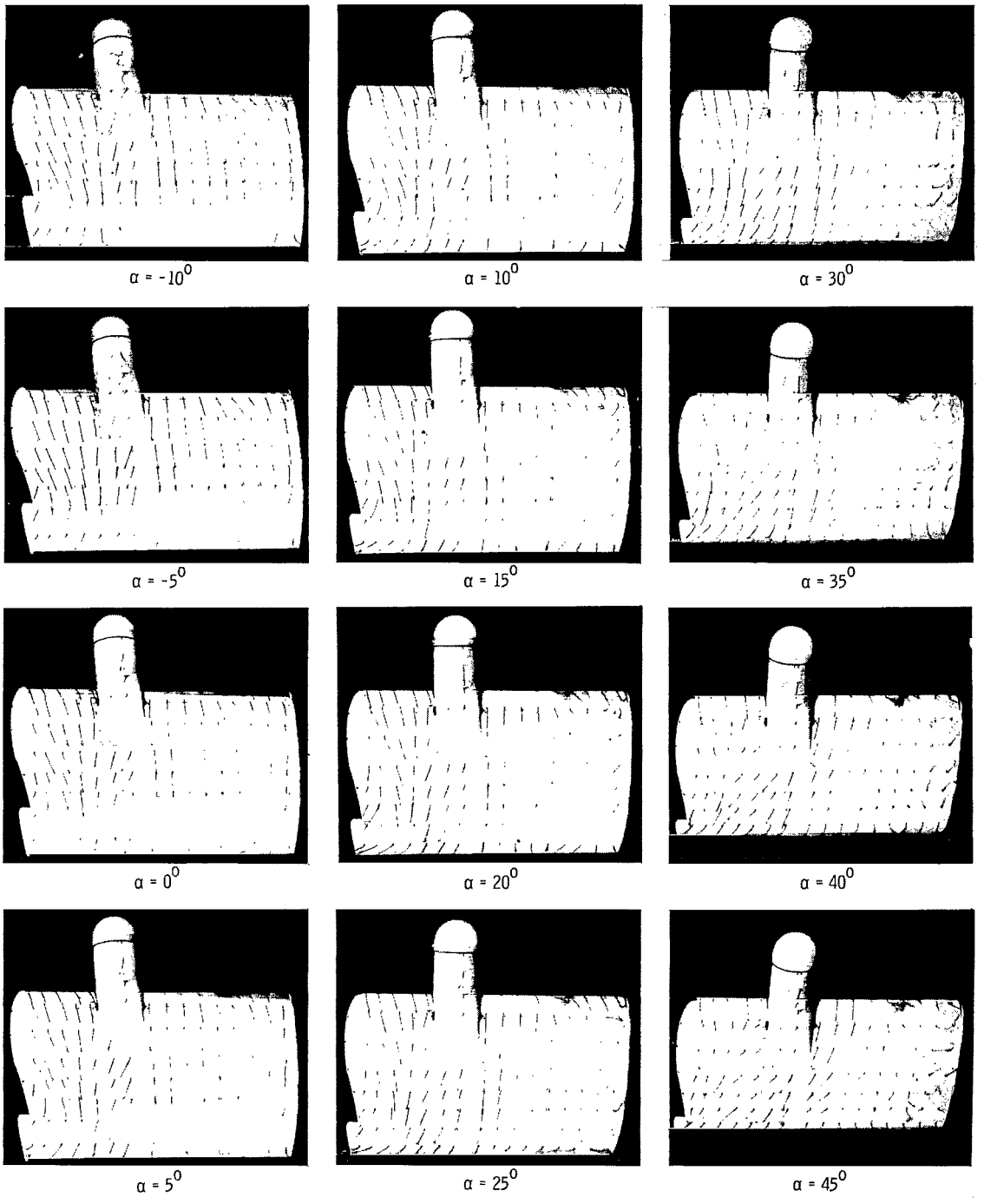
(c) Flow characteristics; $C_{T,s}$ = 0.95. L-63-7570

Figure 10.- Continued.



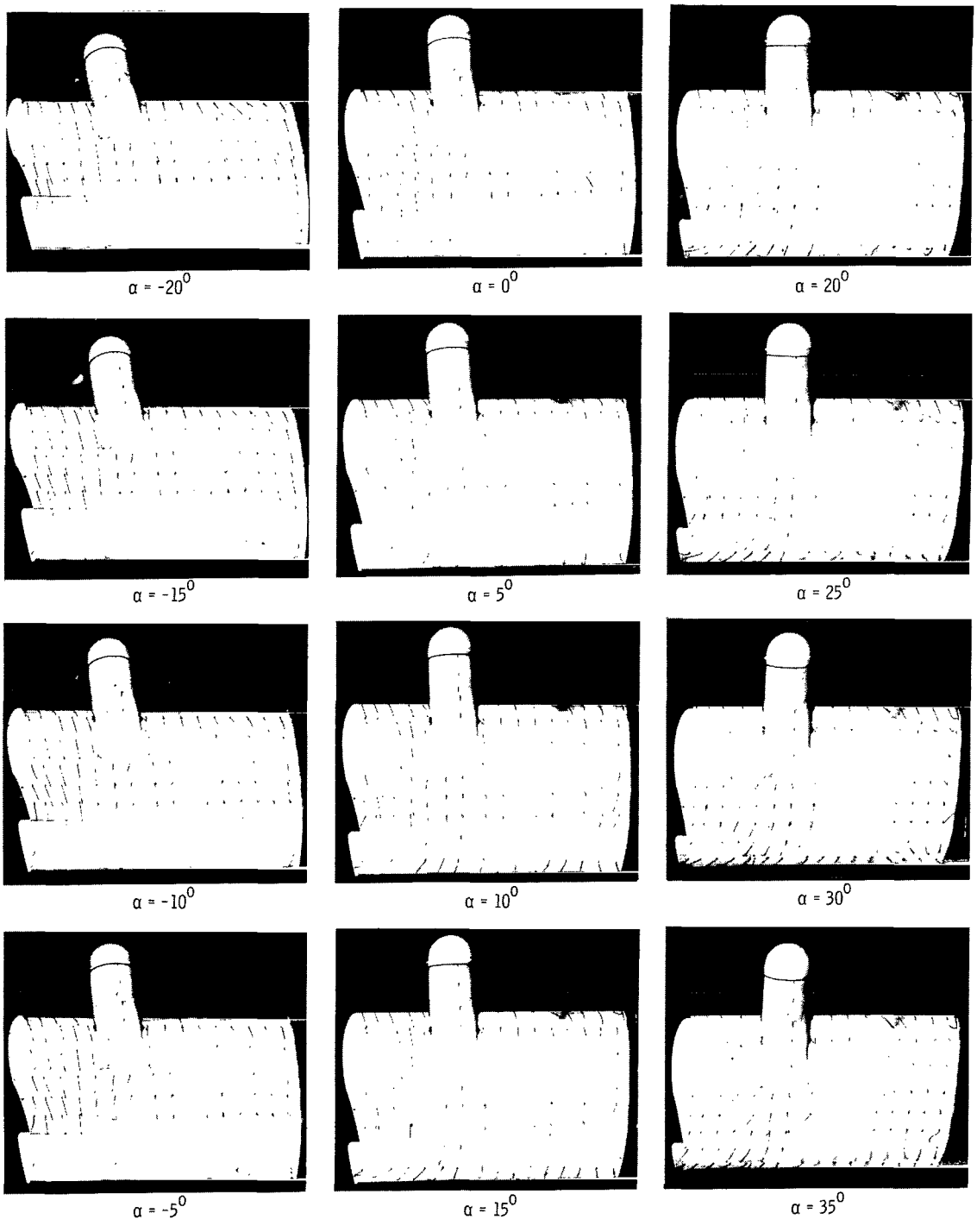
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7571

Figure 10.- Continued.



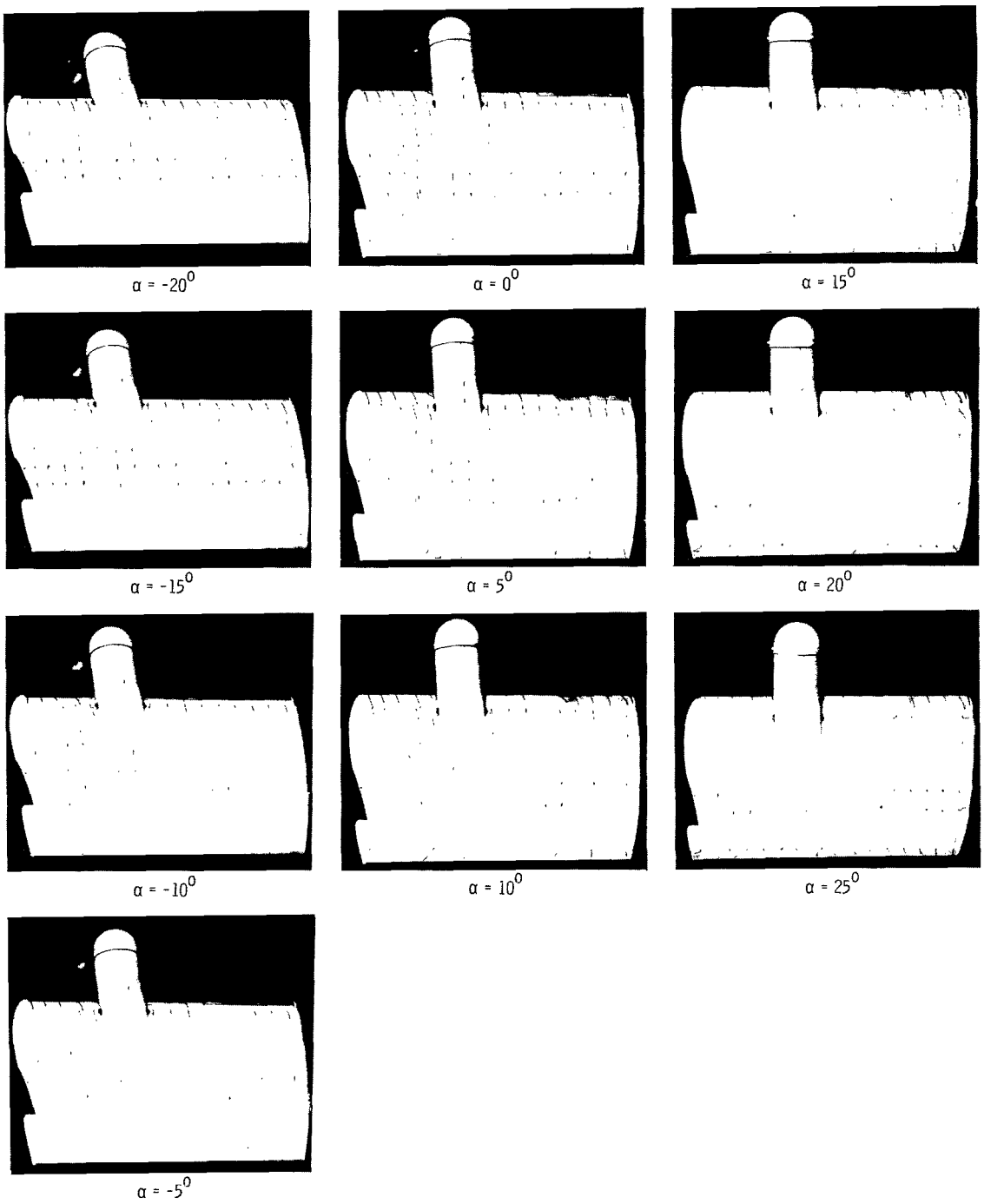
(e) Flow characteristics; $C_{T,s}$ = 0.80. L-63-7572

Figure 10.- Continued.



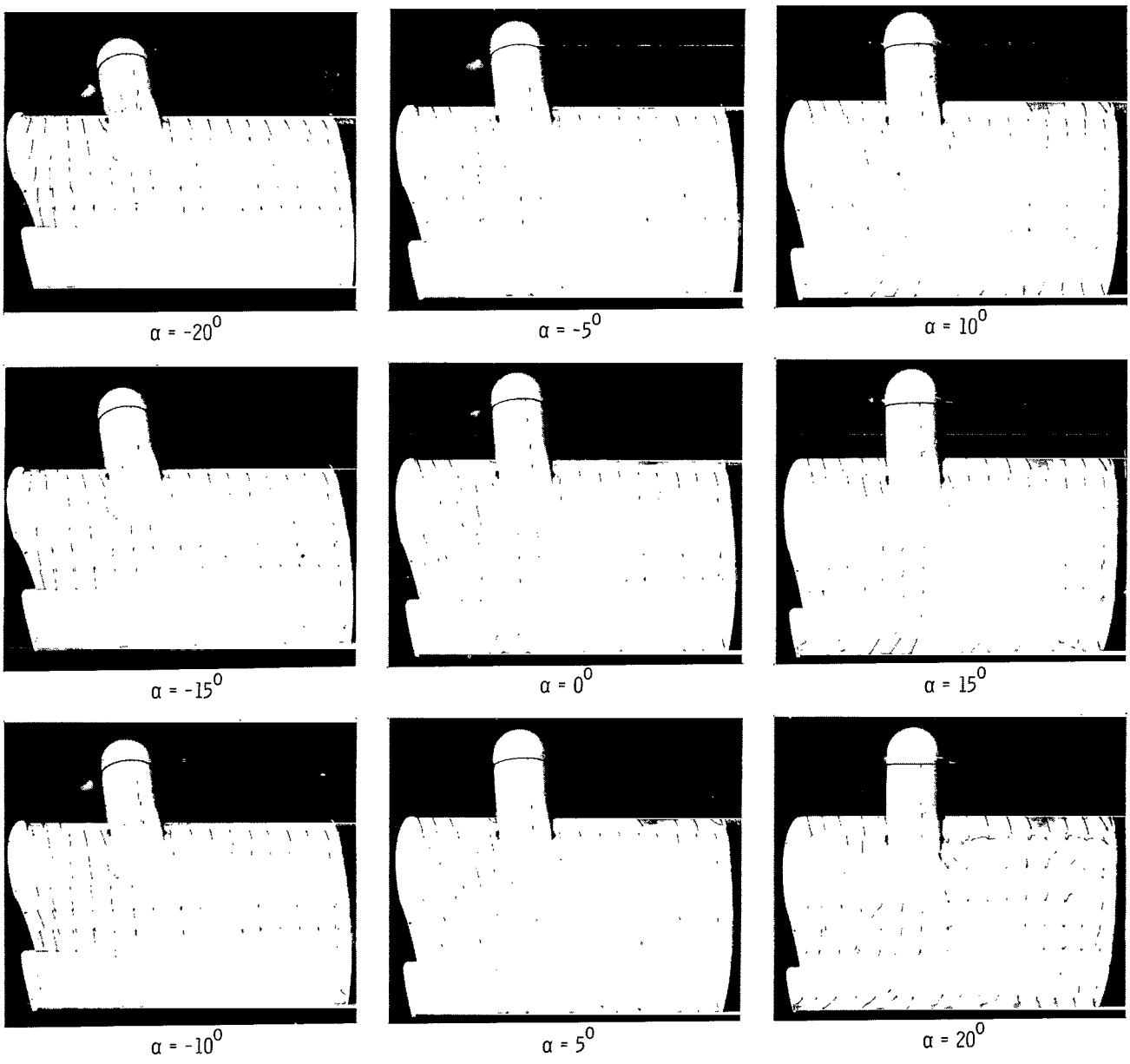
(f) Flow characteristics; $C_{T,s}$ = 0.60. L-63-7573

Figure 10.- Continued.



(g) Flow characteristics; $C_{T,s}$ = 0.30. L-63-7574

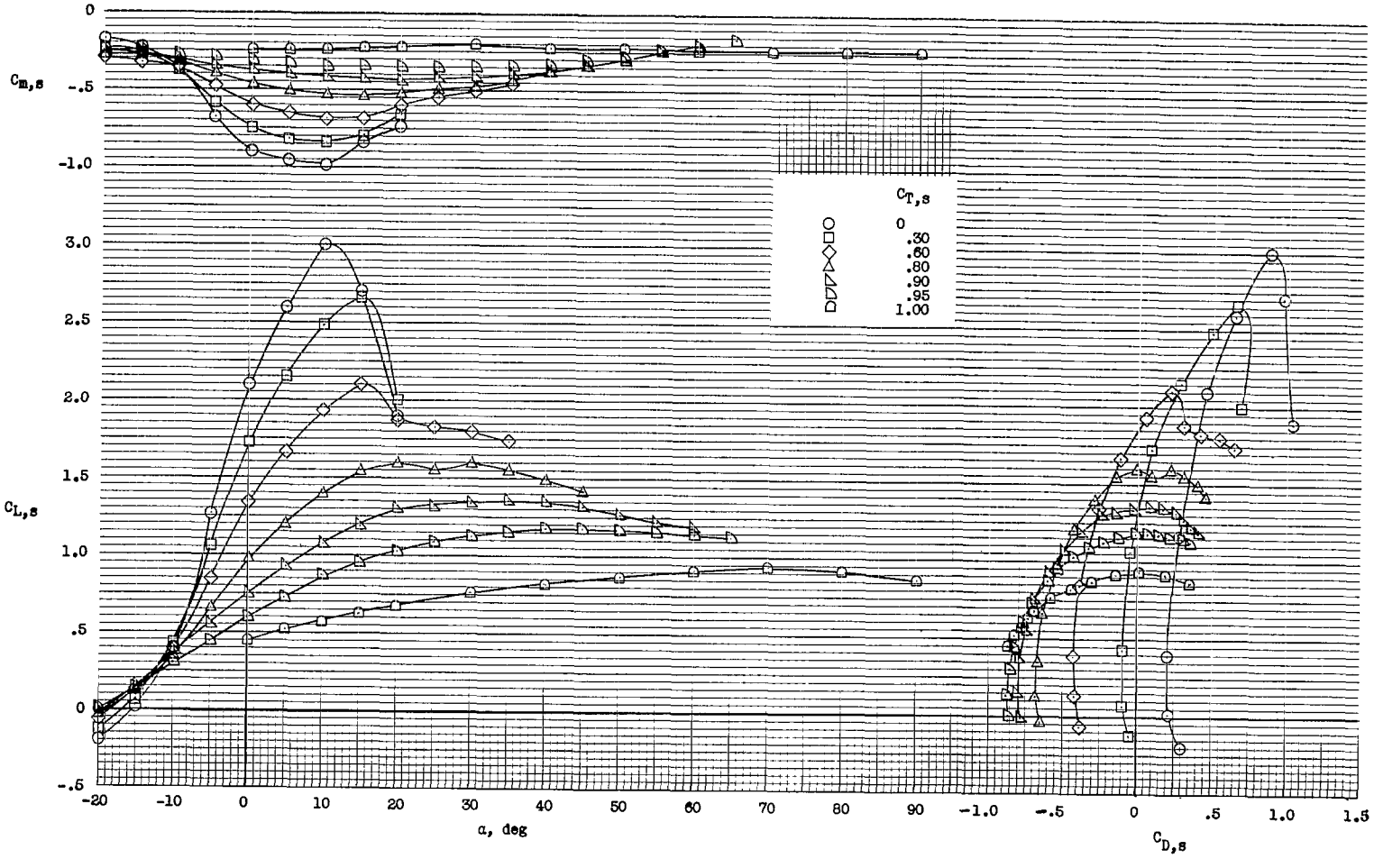
Figure 10.- Continued.



(h) Flow characteristics; $C_{T,s} = 0$.

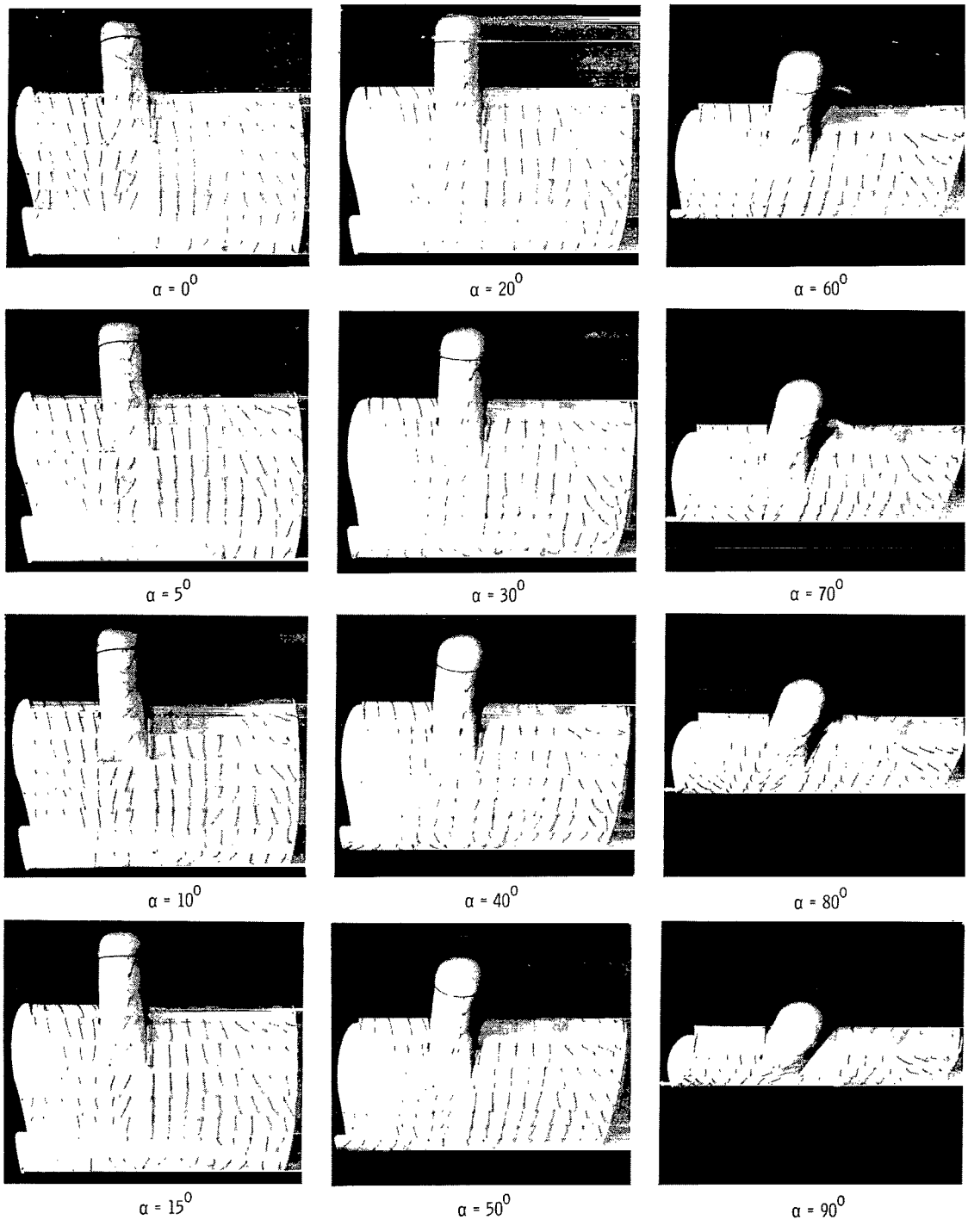
L-63-7575

Figure 10.- Concluded.



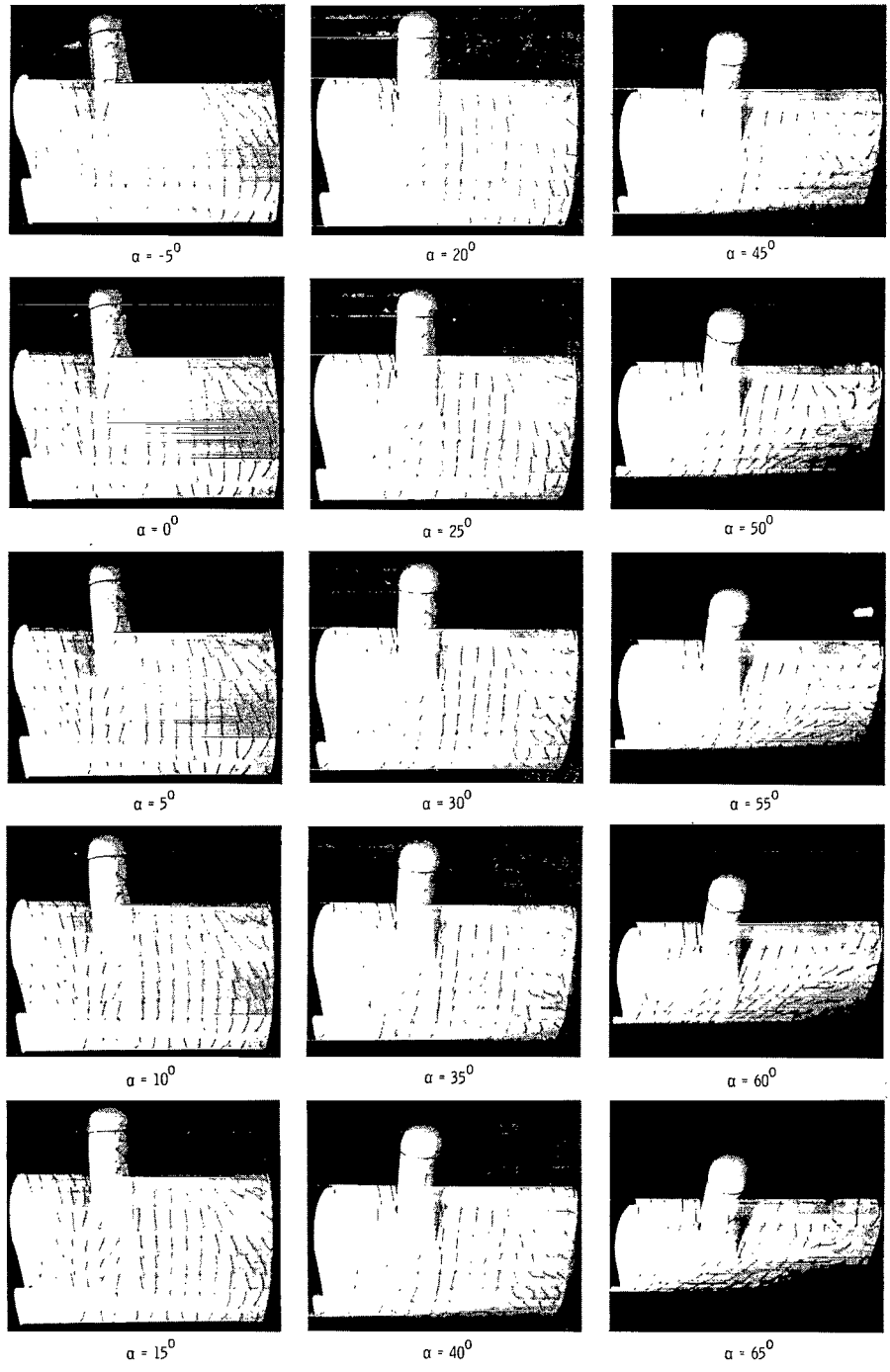
(a) Aerodynamic characteristics.

Figure 11.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 40° and leading-edge droop deflected 30°.



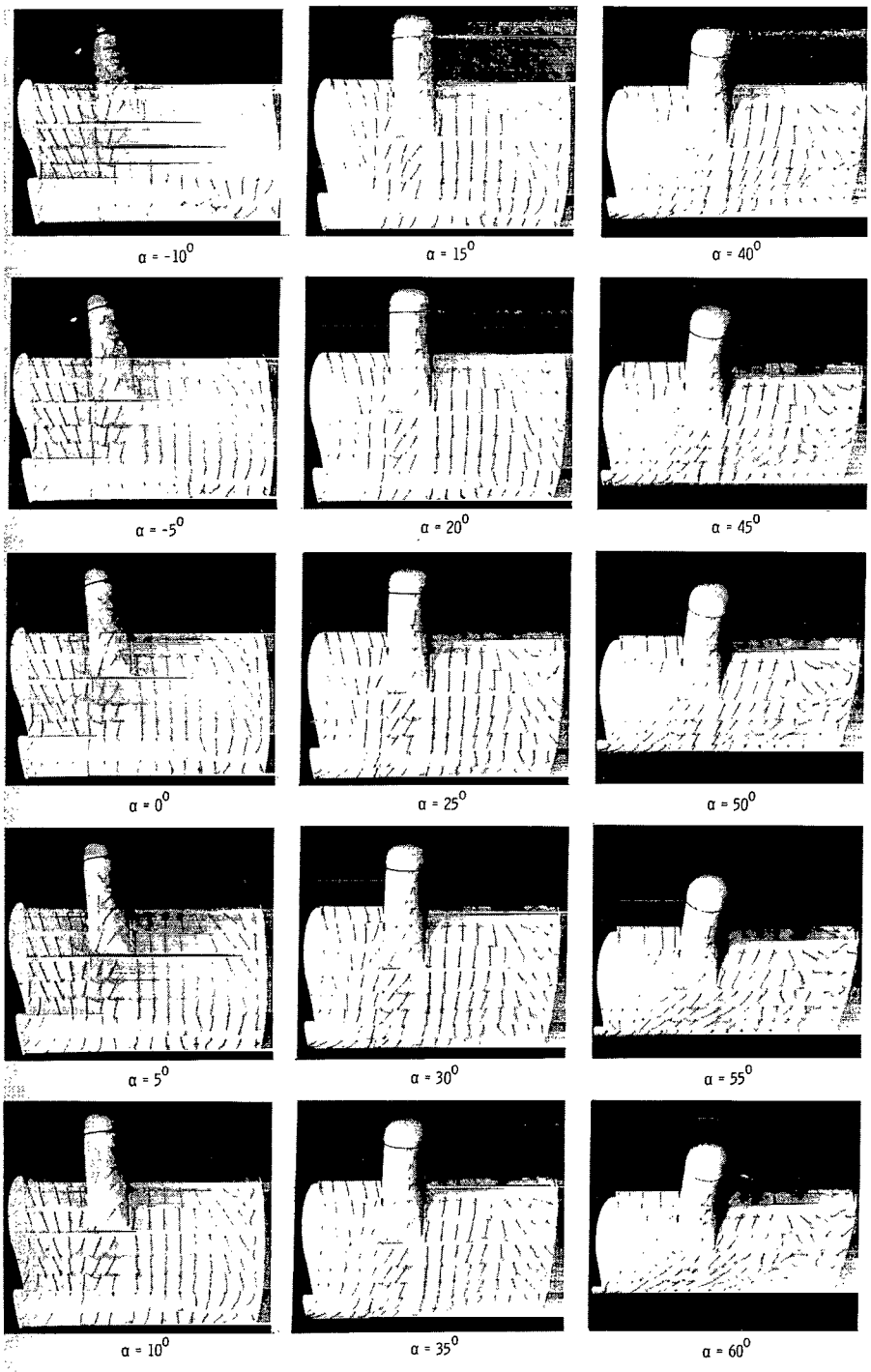
(b) Flow characteristics; $C_{T,s}$ = 1.00. L-63-7576

Figure 11.- Continued.



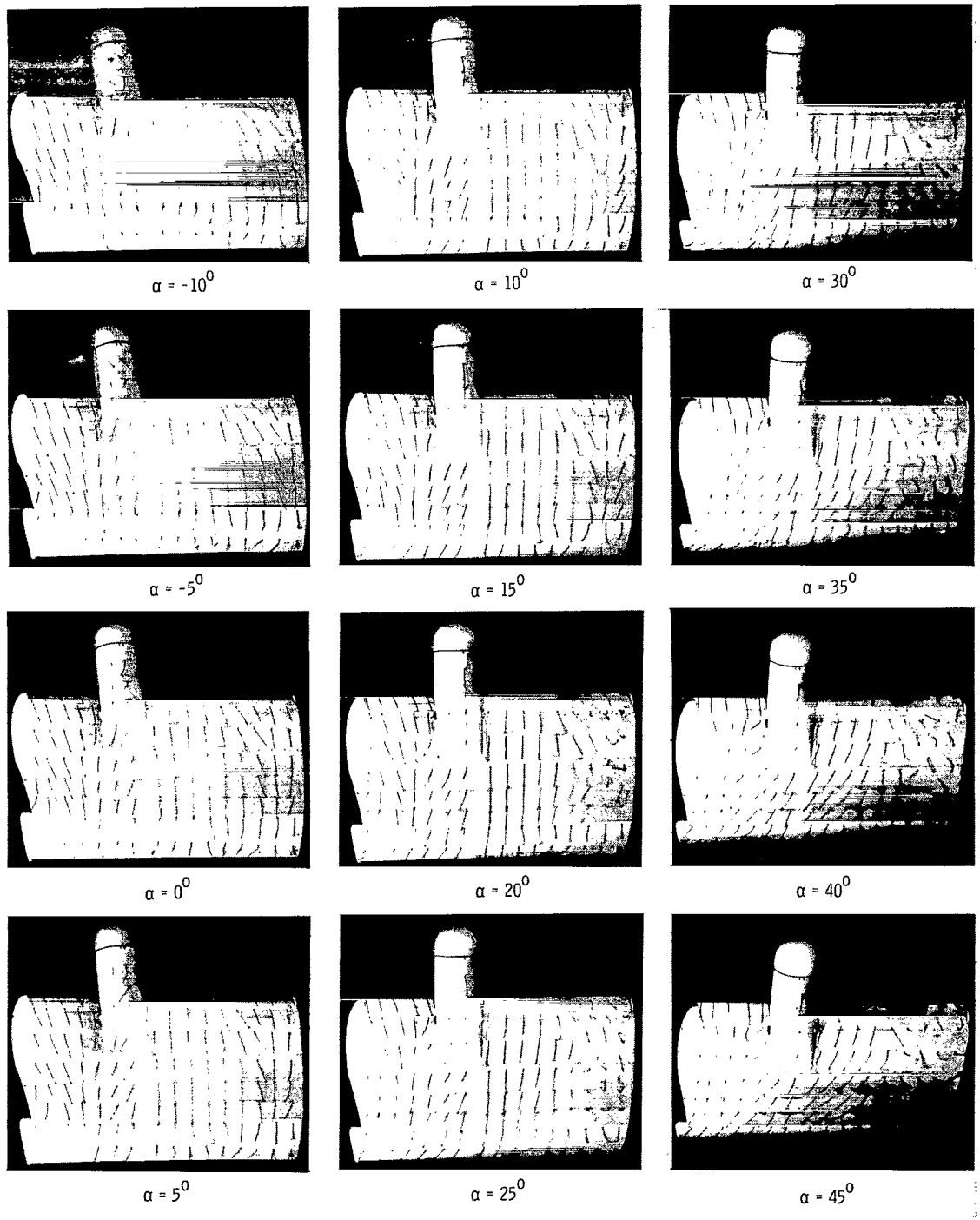
(c) Flow characteristics; $C_{T,s}$ = 0.95. L-63-7577

Figure 11.- Continued.



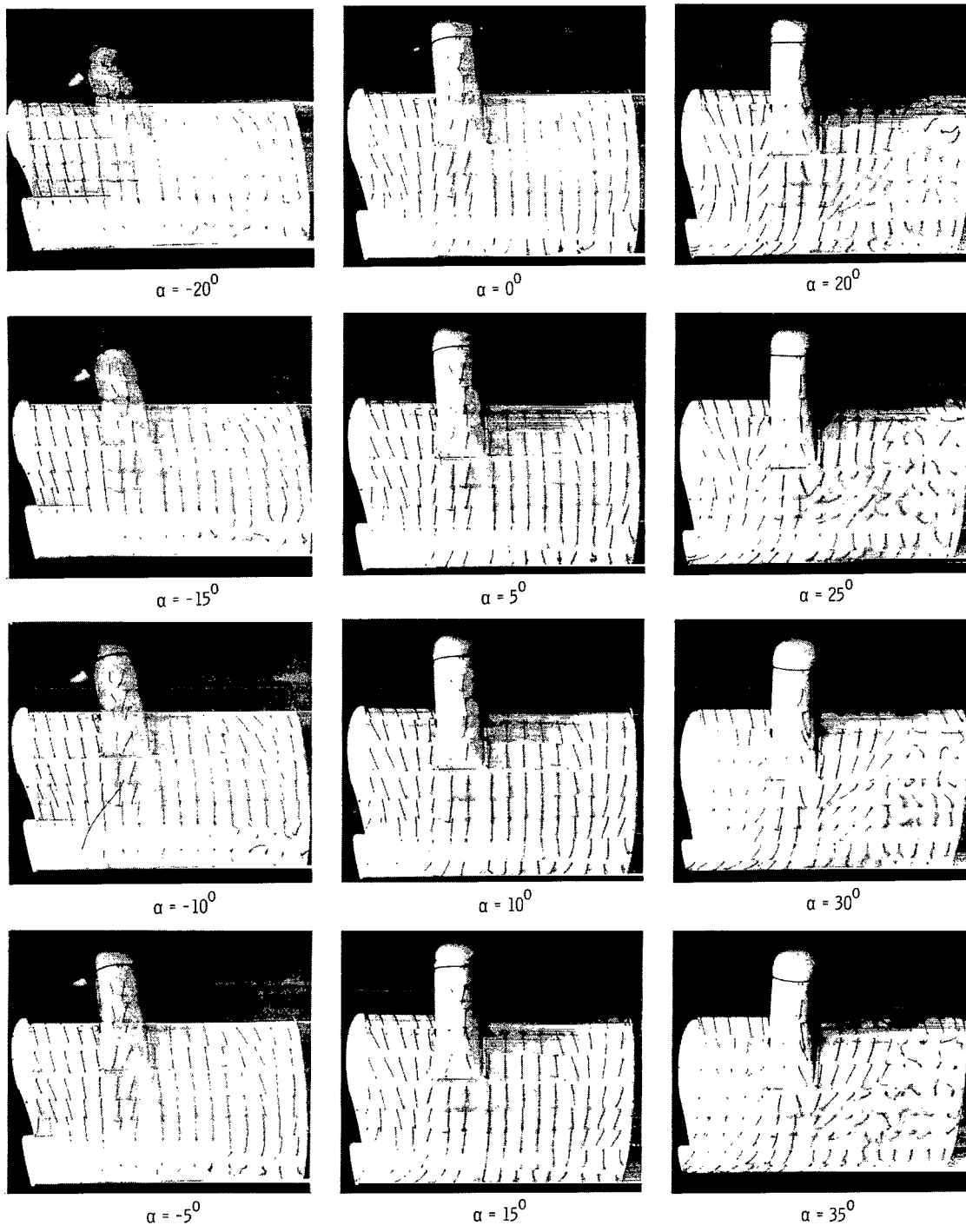
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7578

Figure 11.- Continued.



(e) Flow characteristics; $C_{T,s}$ = 0.80. L-63-7579

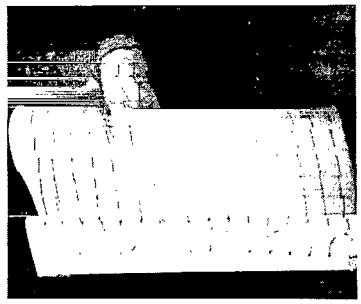
Figure 11.- Continued.



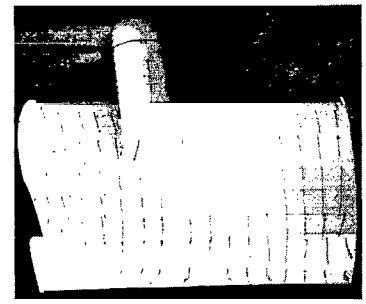
(f) Flow characteristics; $C_{T,s} = 0.60$.

L-63-7580

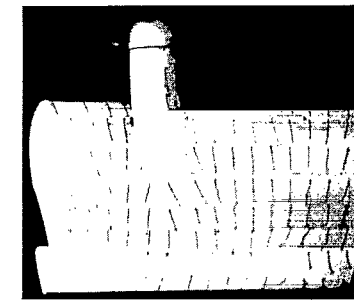
Figure 11.- Continued.



$\alpha = -20^0$



$\alpha = 0^0$



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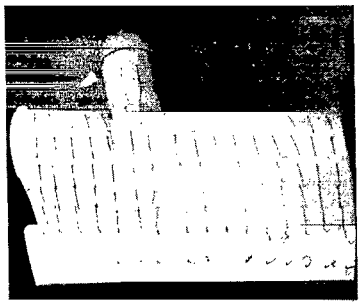
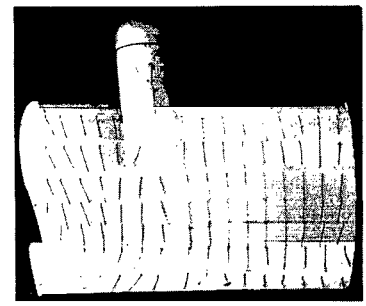
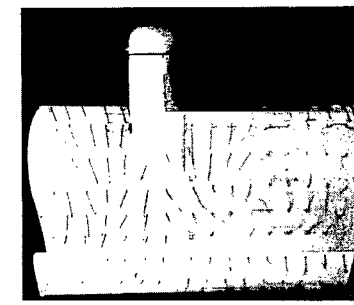


$\alpha = -15^0$



$\alpha = 5^0$



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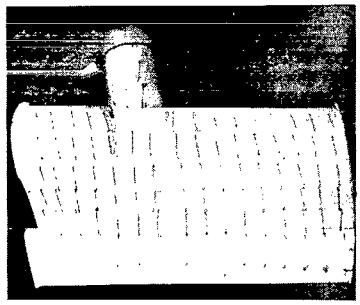

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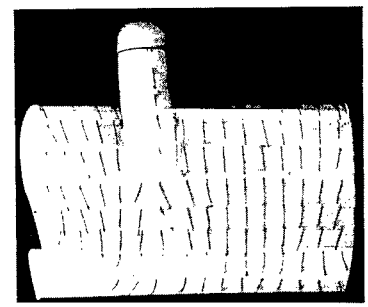

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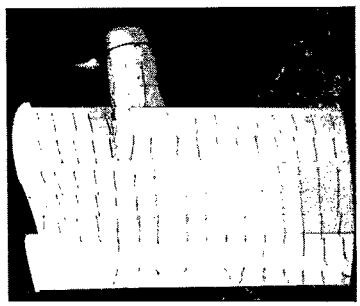
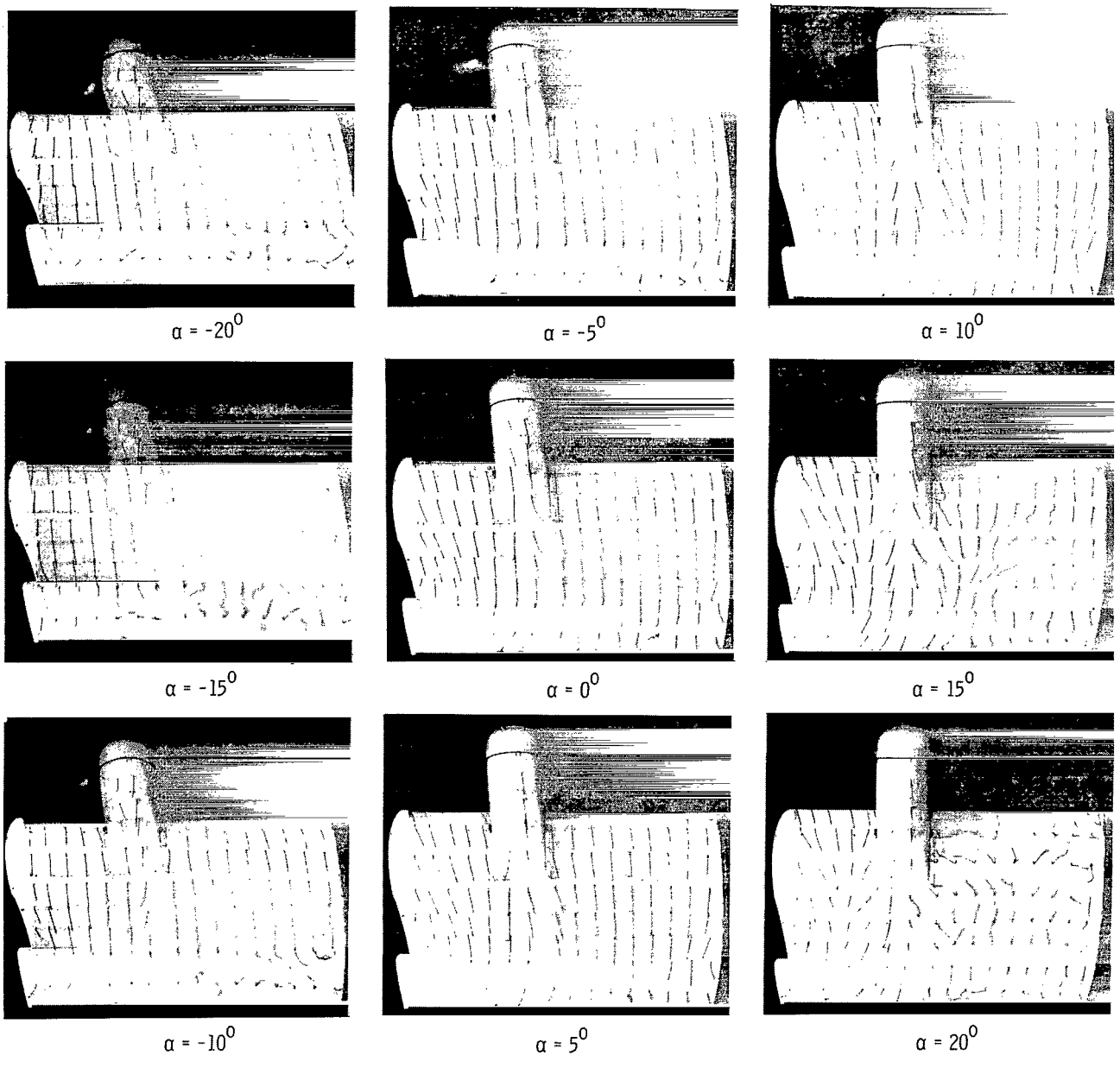


$\alpha = -5^0$

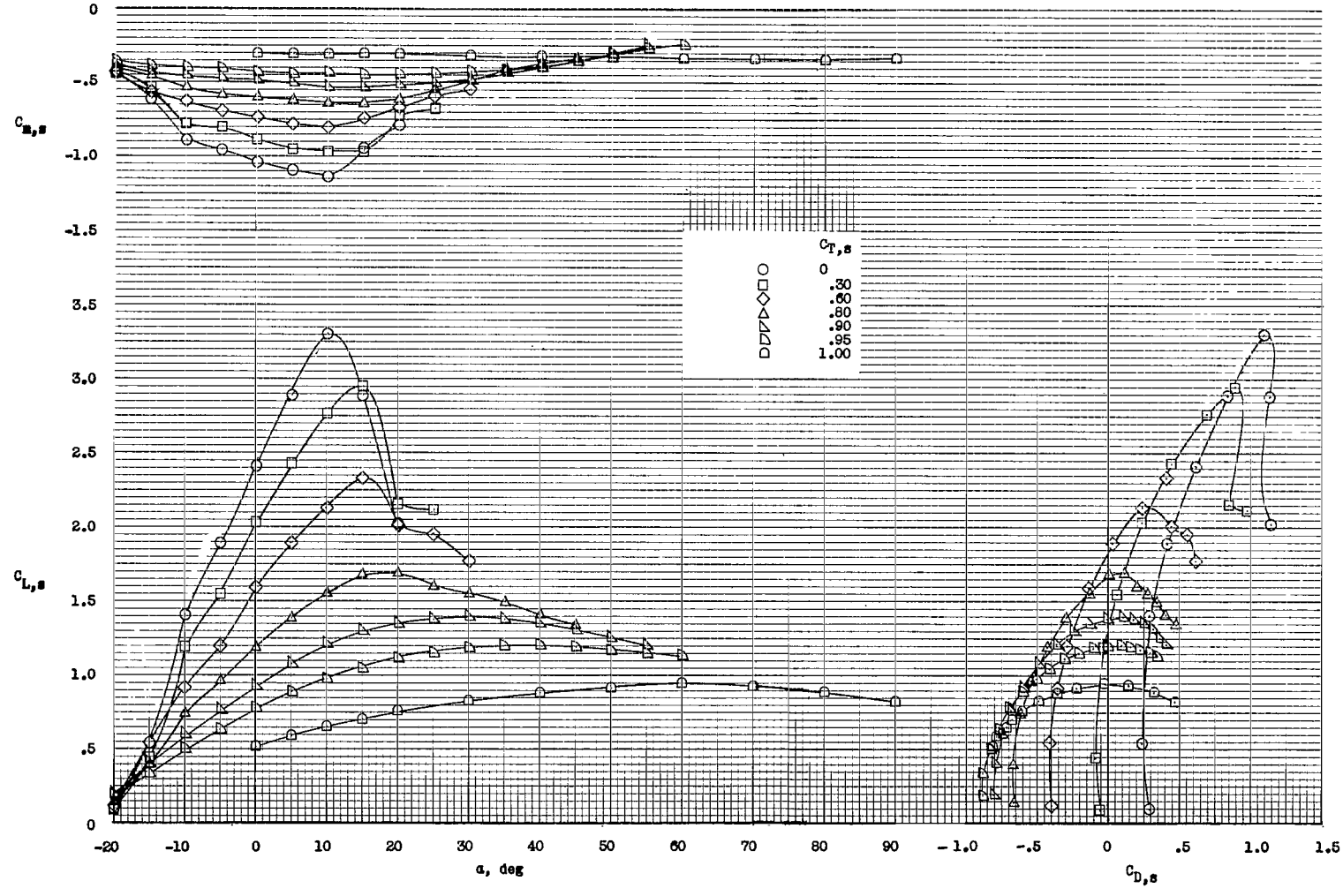
(g) Flow characteristics; $C_{T,s} = 0.30$. L-63-7581

Figure 11.- Continued.



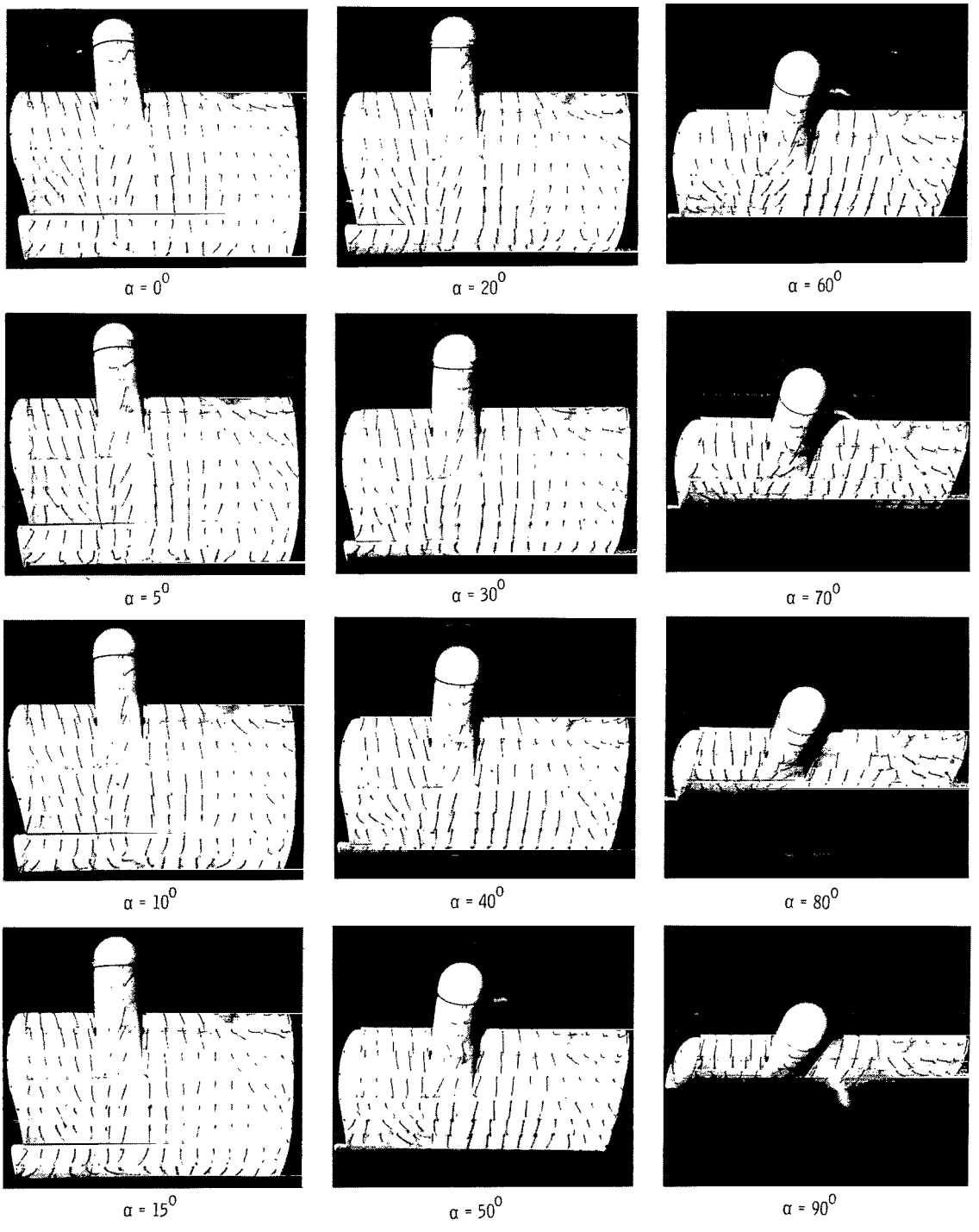
(h) Flow characteristics; $C_{T,s} = 0$. L-63-7582

Figure 11.- Concluded.



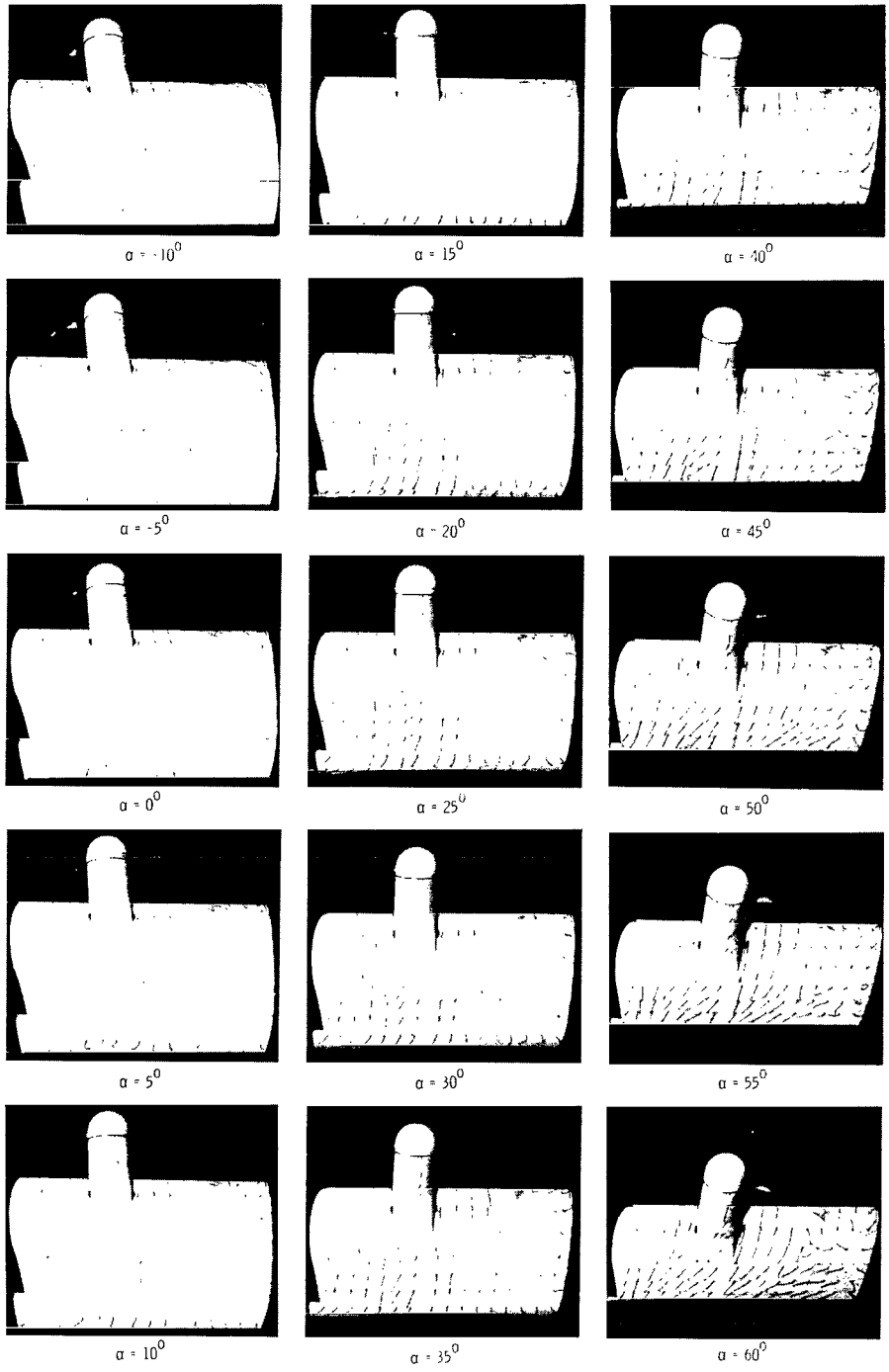
(a) Aerodynamic characteristics.

Figure 12.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and leading-edge droop deflected 10°.



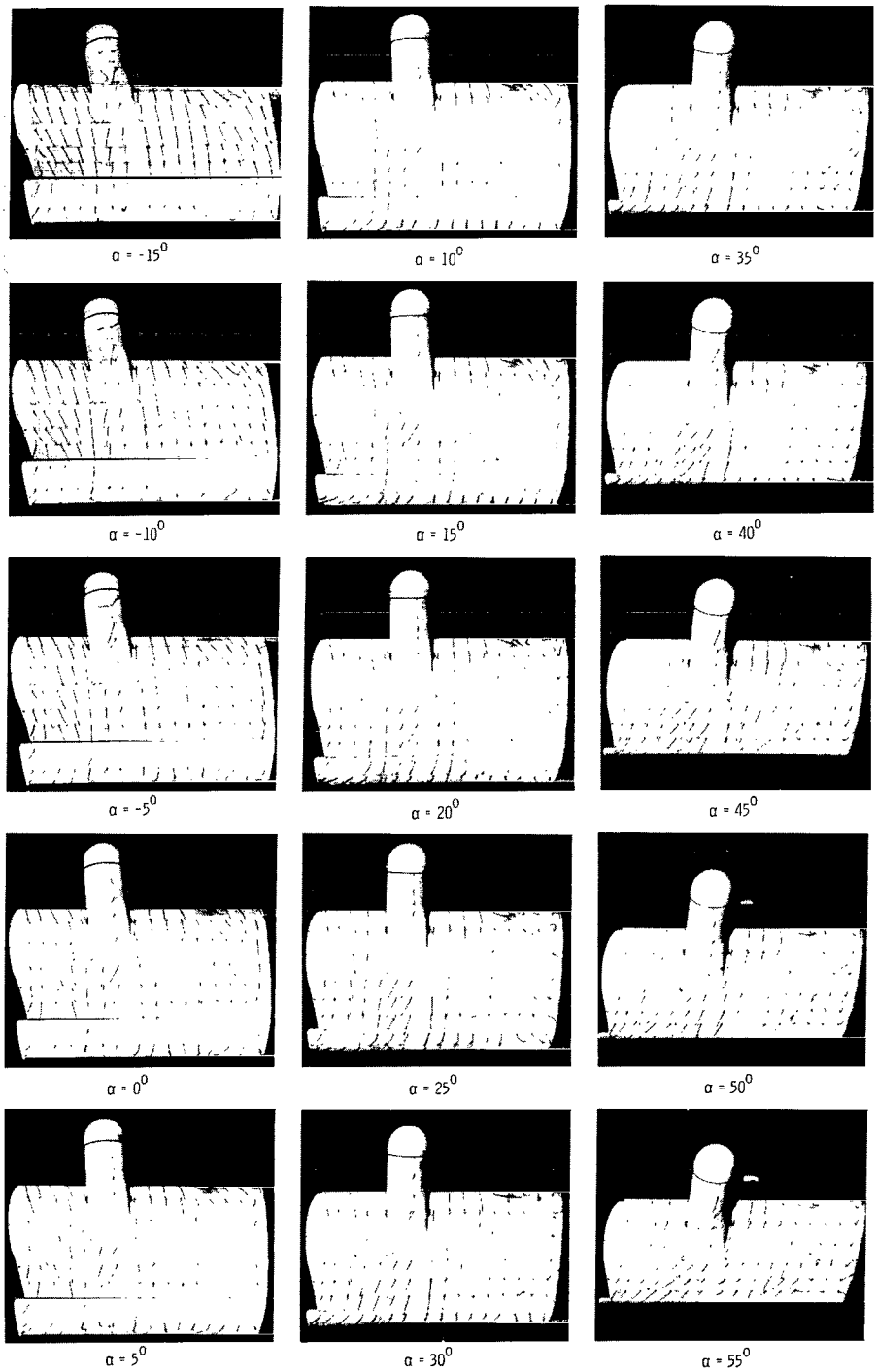
(b) Flow characteristics; $C_{T,S}$ = 1.00. L-63-7583

Figure 12.- Continued.



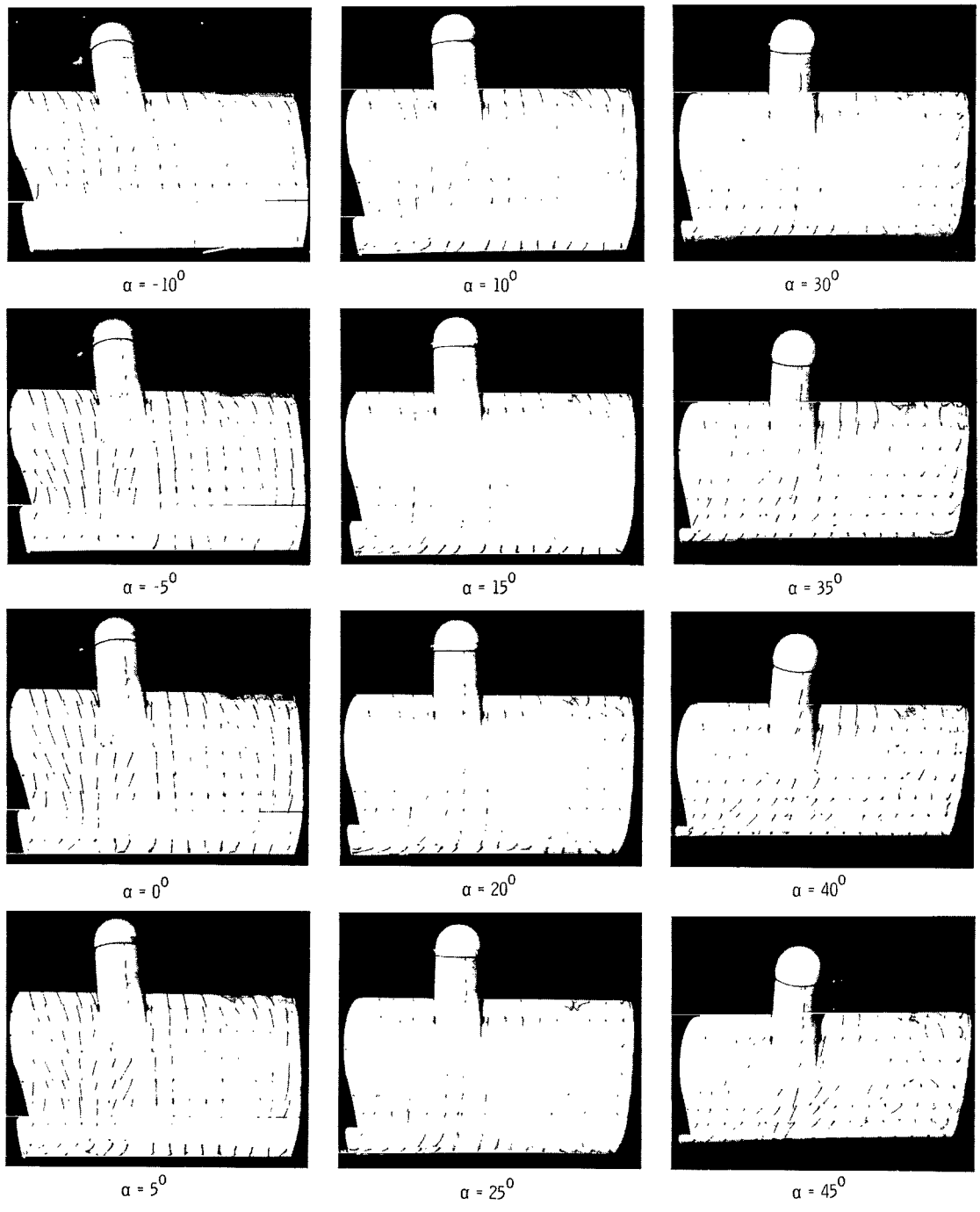
(c) Flow characteristics; $C_{T,s}$ = 0.95. L-63-7584

Figure 12.- Continued.



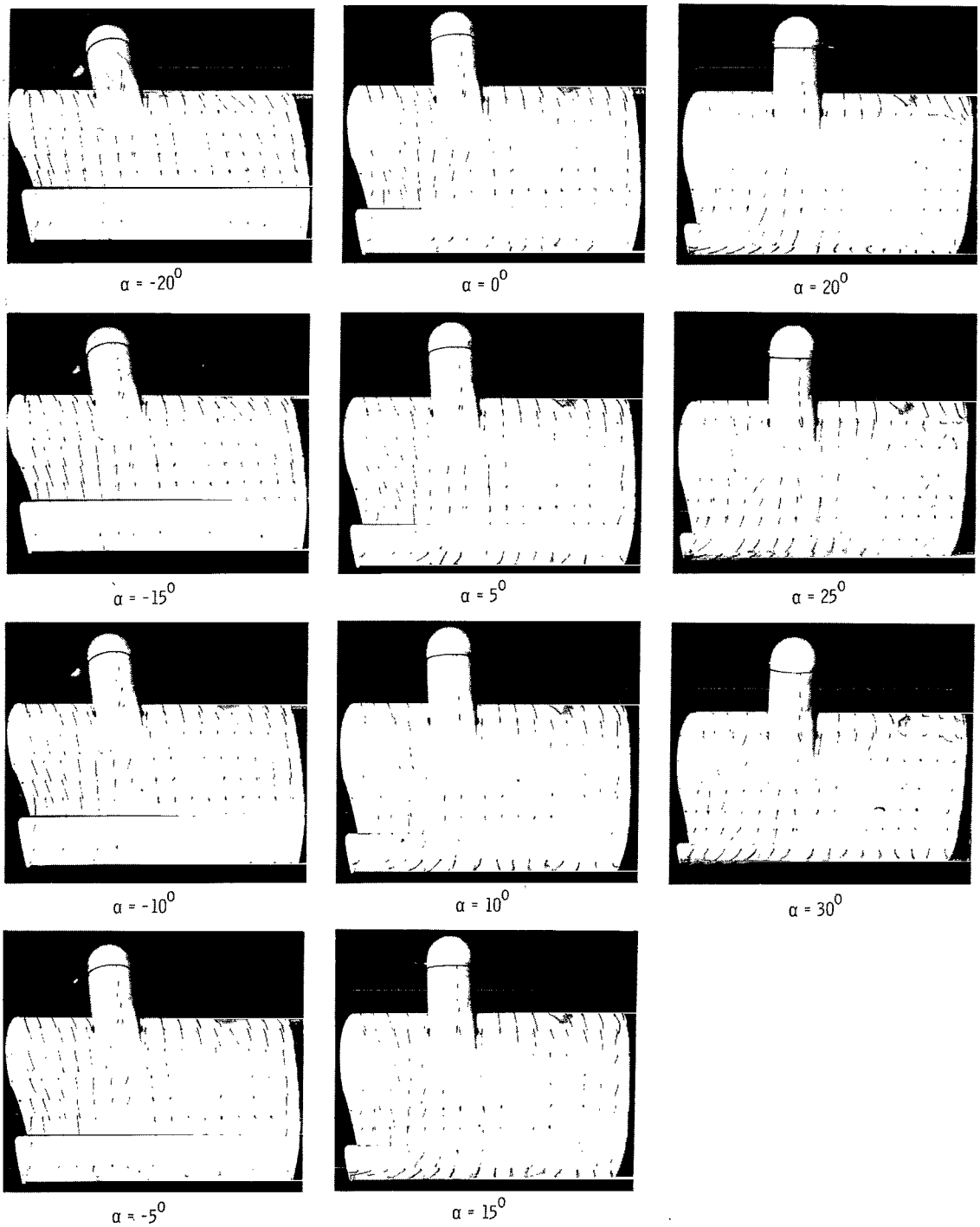
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7585

Figure 12.- Continued.



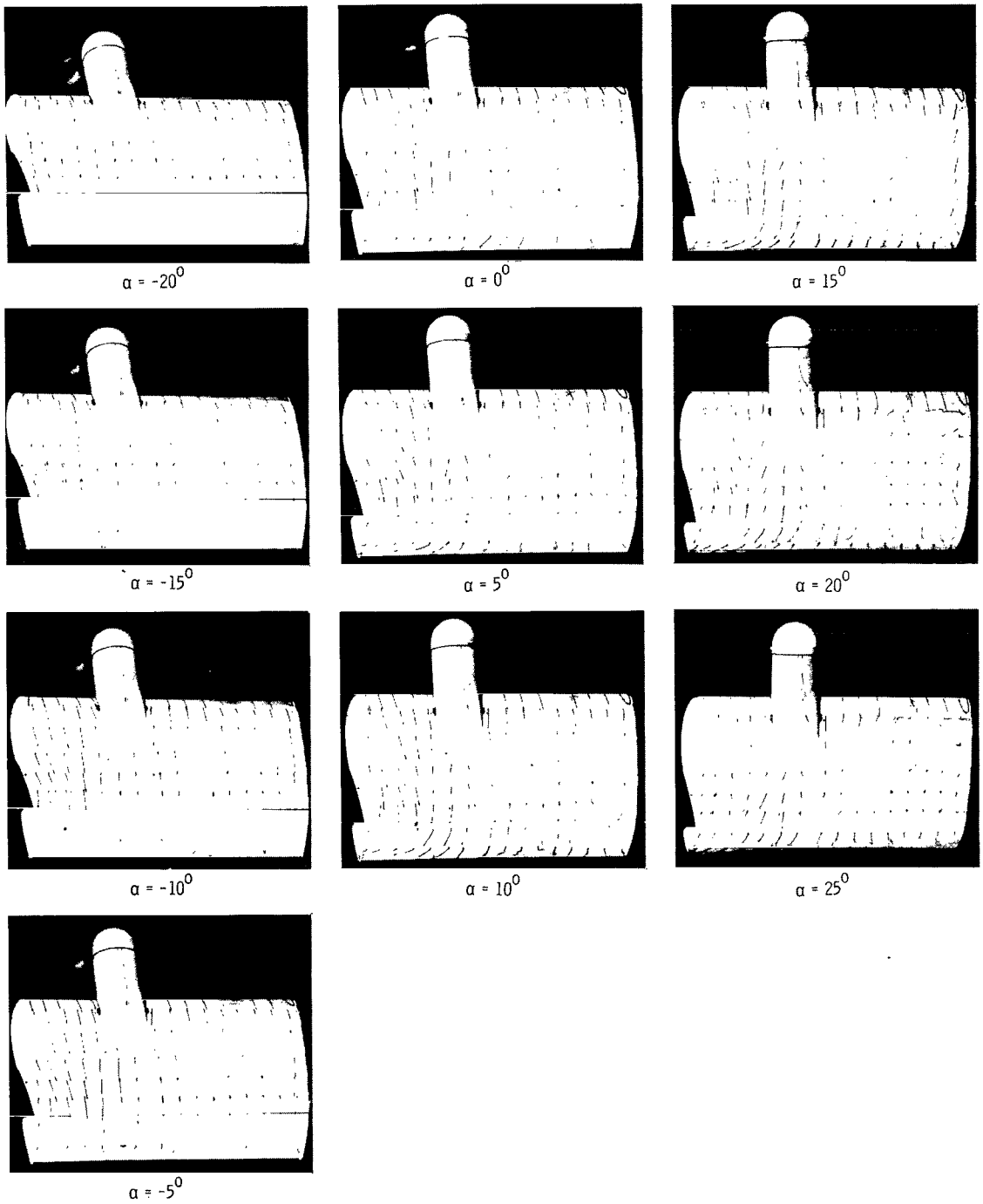
(e) Flow characteristics; $C_{T,s}$ = 0.80. L-63-7586

Figure 12.- Continued.



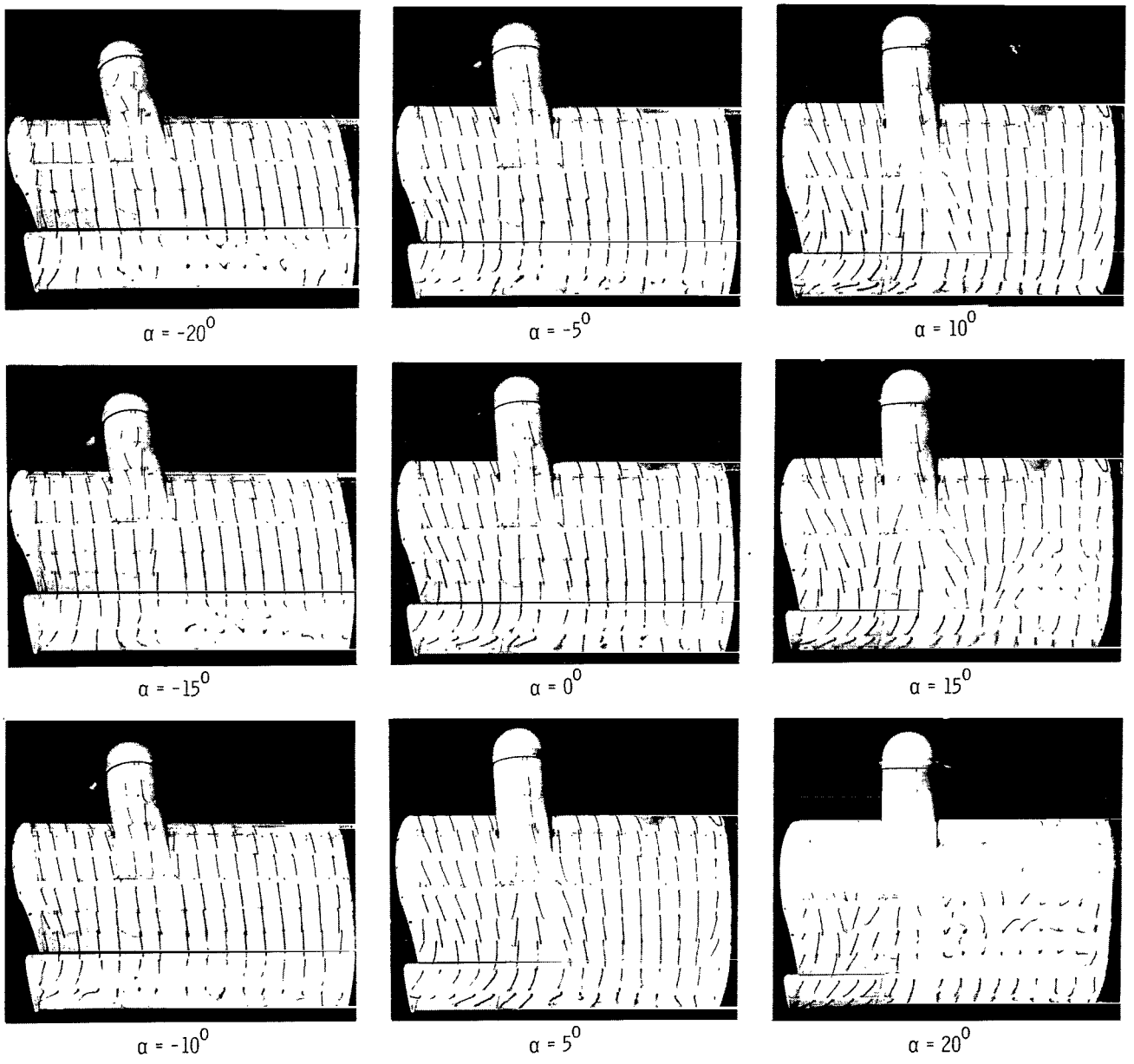
(f) Flow characteristics; $C_{T,s}$ = 0.60. L-63-7587

Figure 12.- Continued.



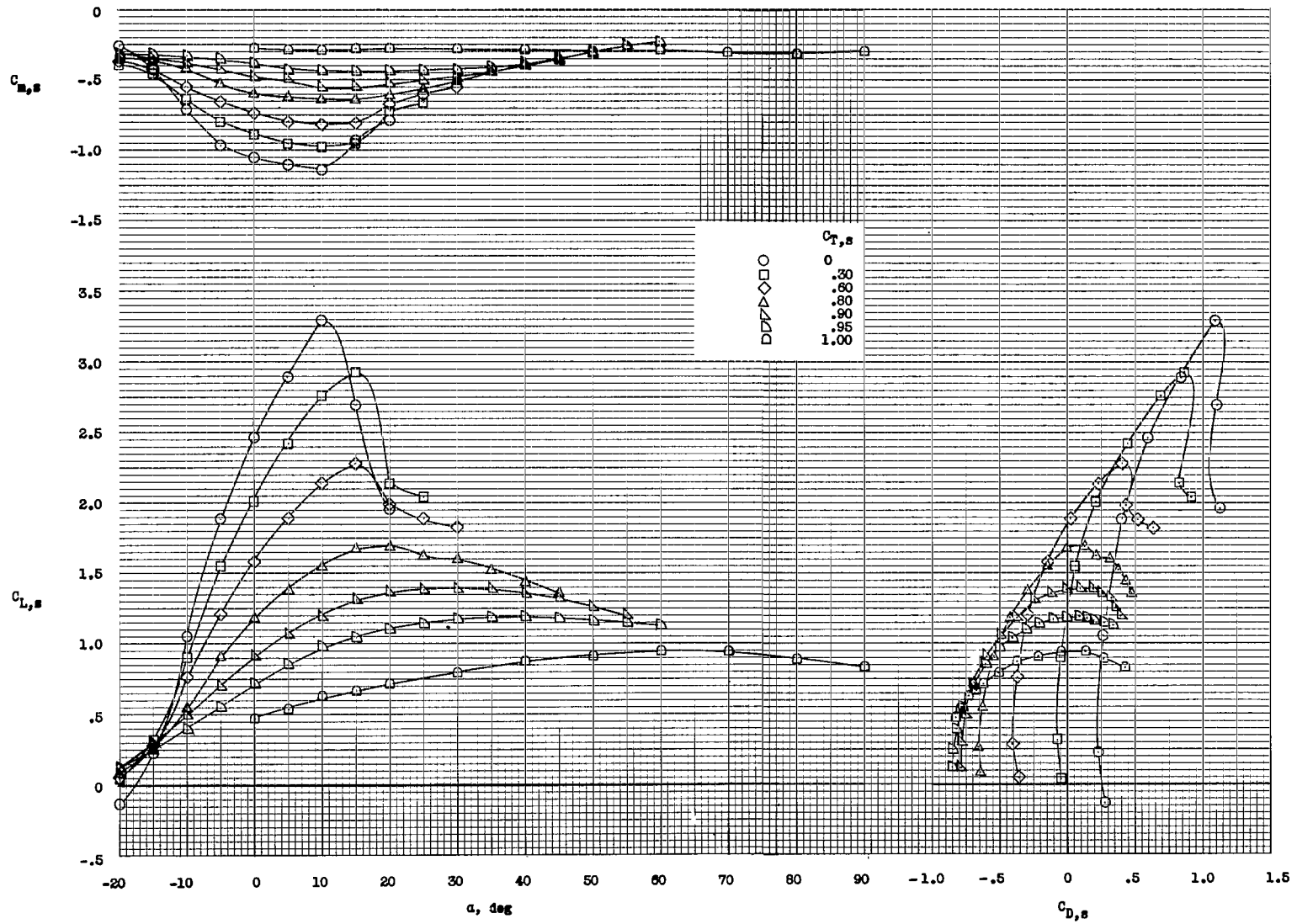
(g) Flow characteristics; $C_{T,s}$ = 0.30. L-63-7588

Figure 12.- Continued.



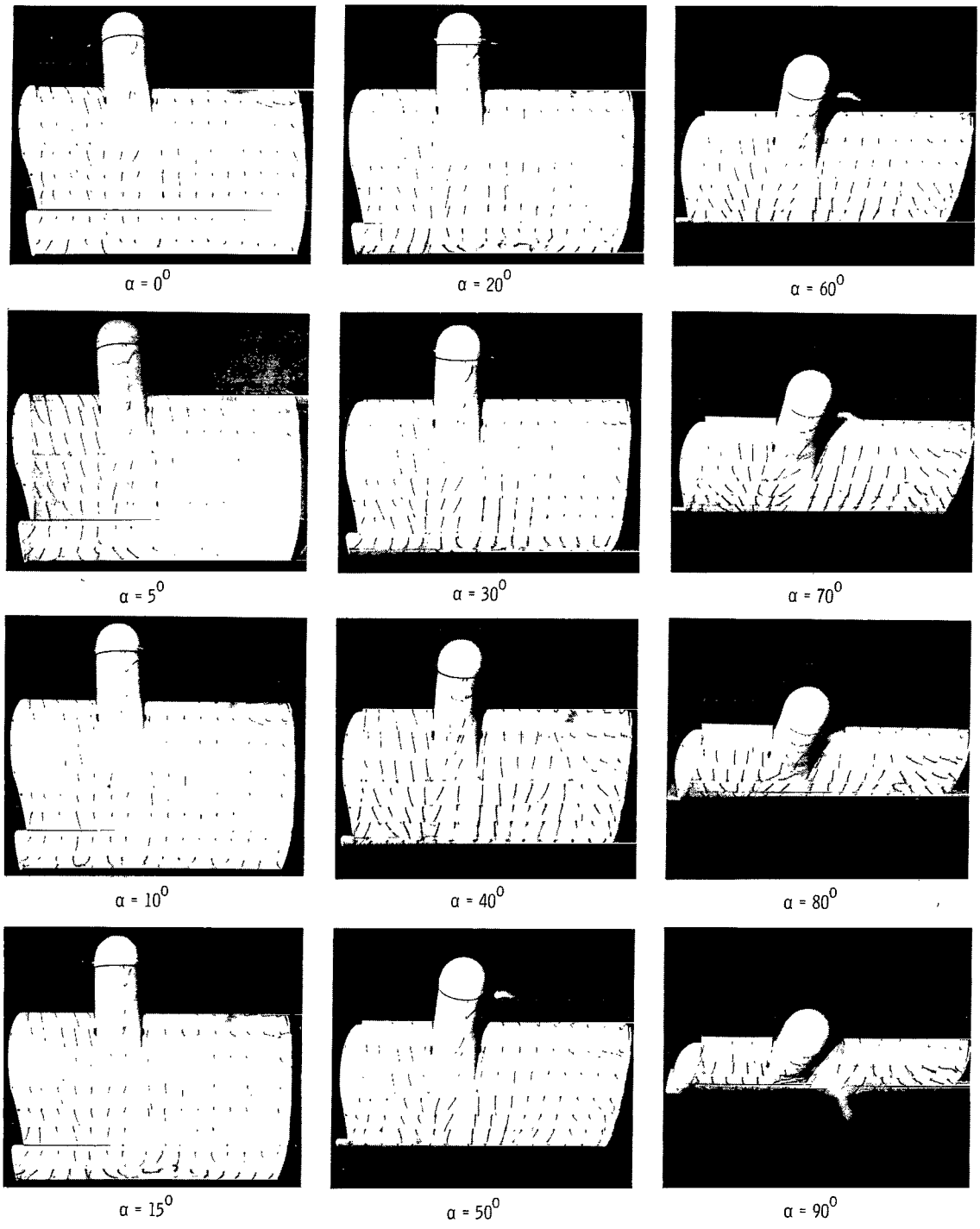
(h) Flow characteristics; $C_{T,s} = 0$. L-63-7589

Figure 12.- Concluded.



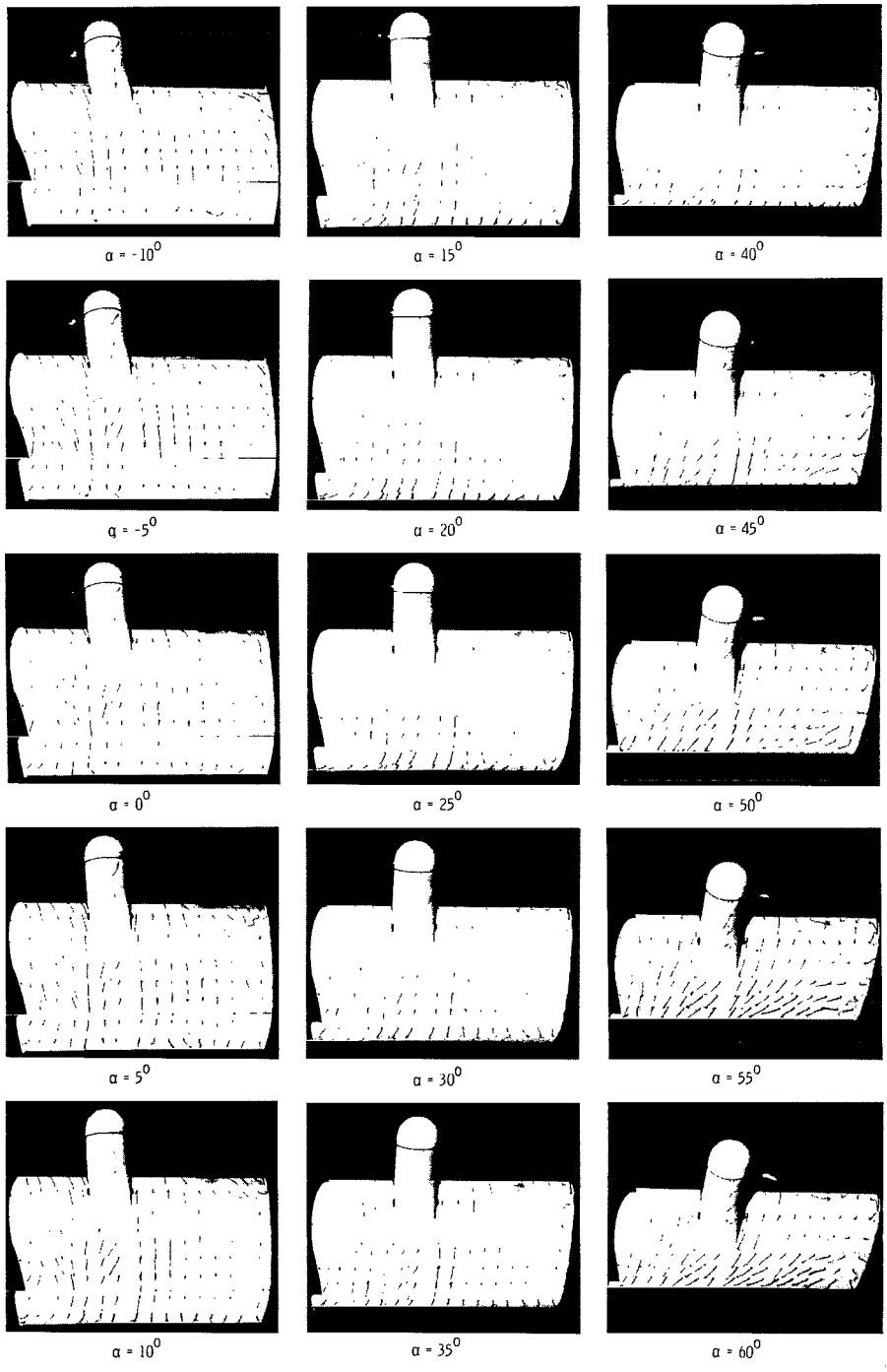
(a) Aerodynamic characteristics.

Figure 13.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and leading-edge droop deflected 20°.



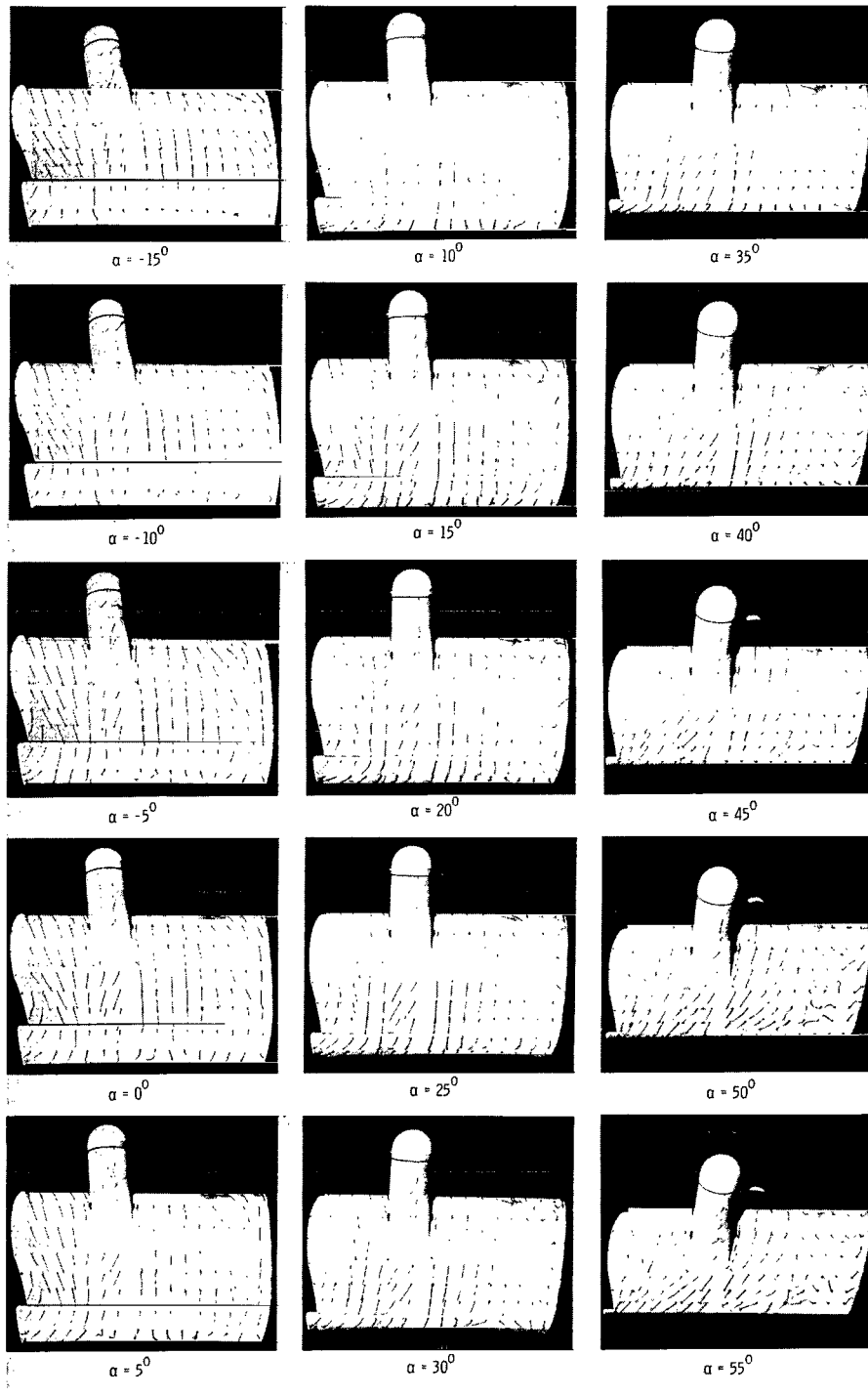
(b) Flow characteristics; $C_{T,s}$ = 1.00. L-63-7590

Figure 13.- Continued.



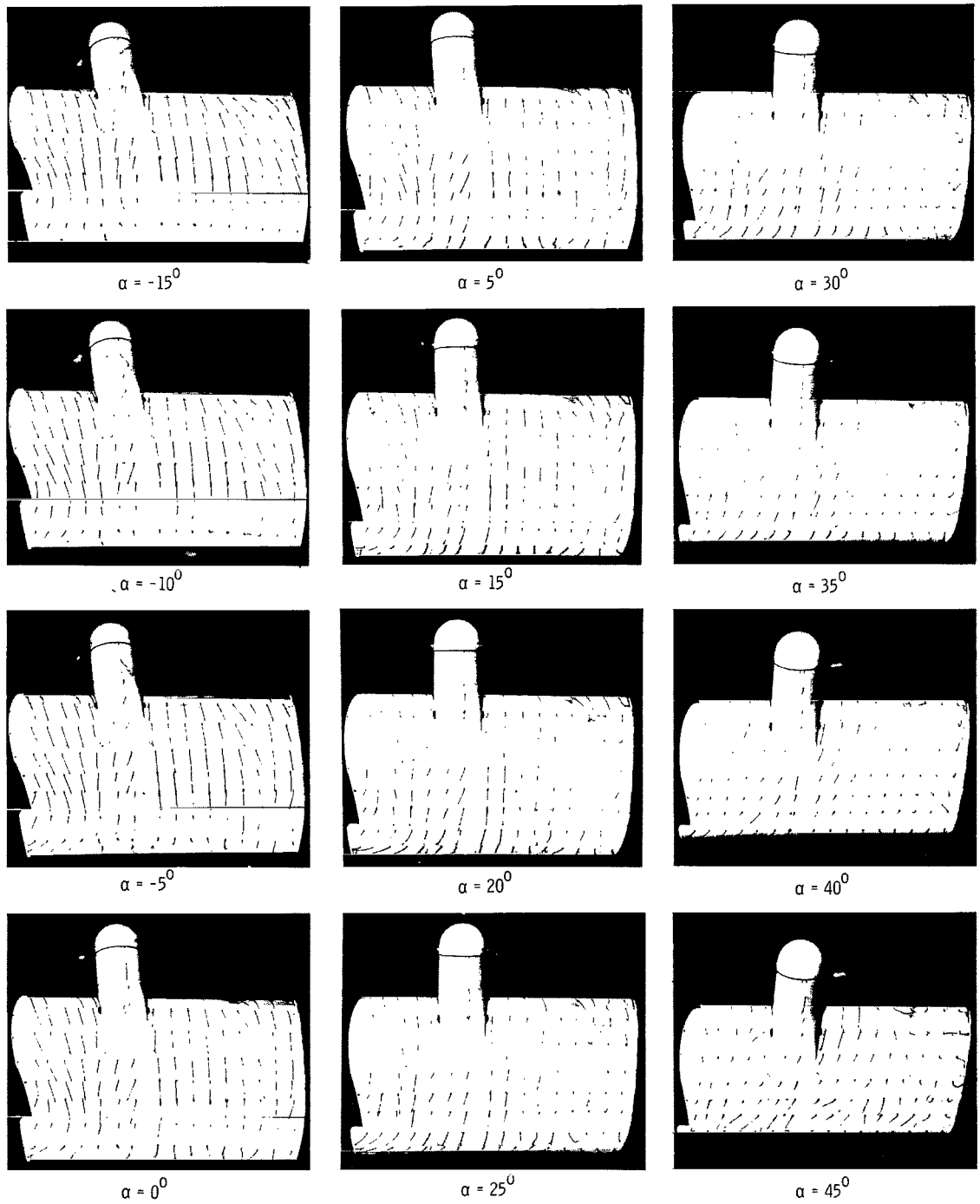
(c) Flow characteristics; $C_{T,s} = 0.95$. L-63-7591

Figure 13.- Continued.



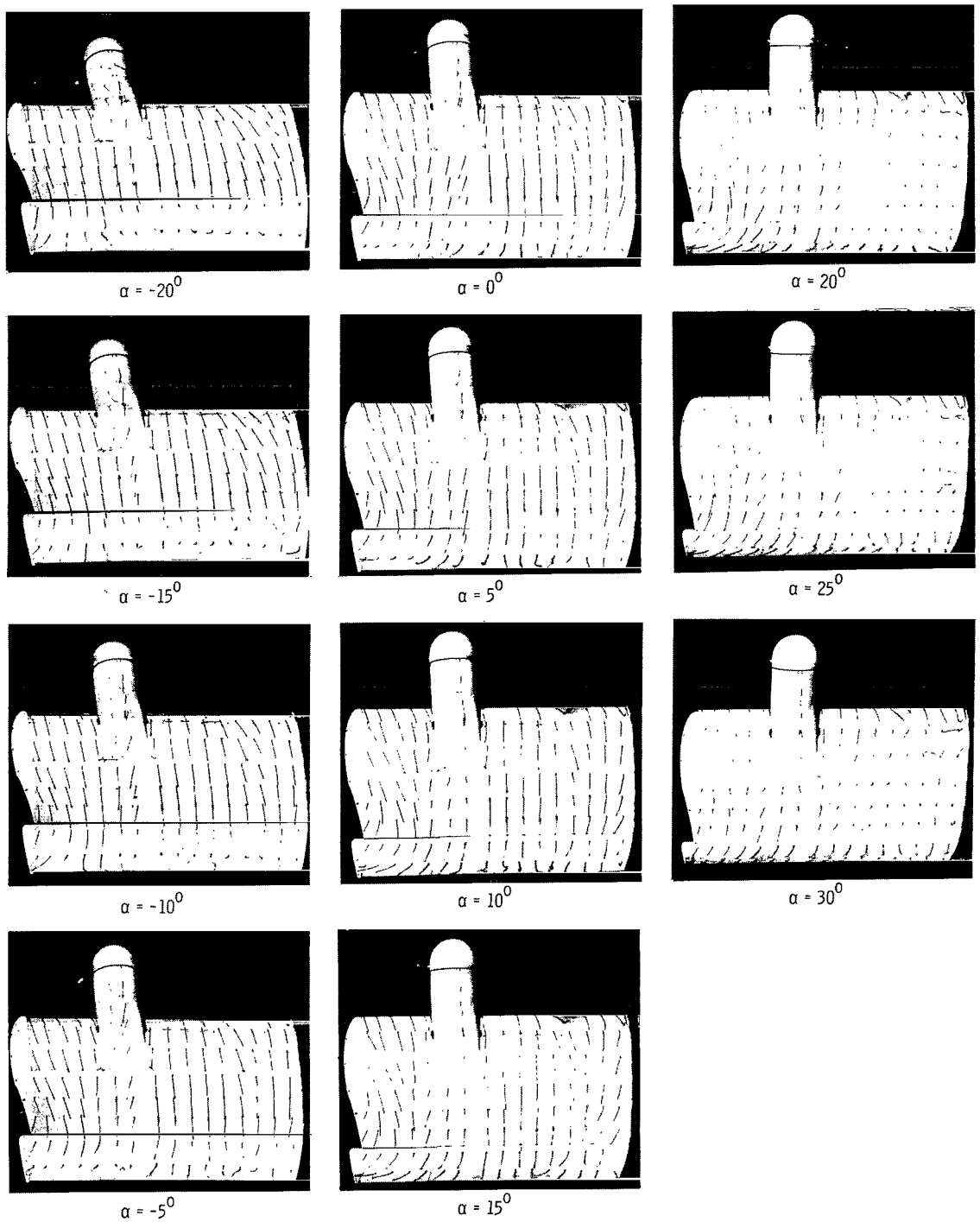
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7592

Figure 13.- Continued.



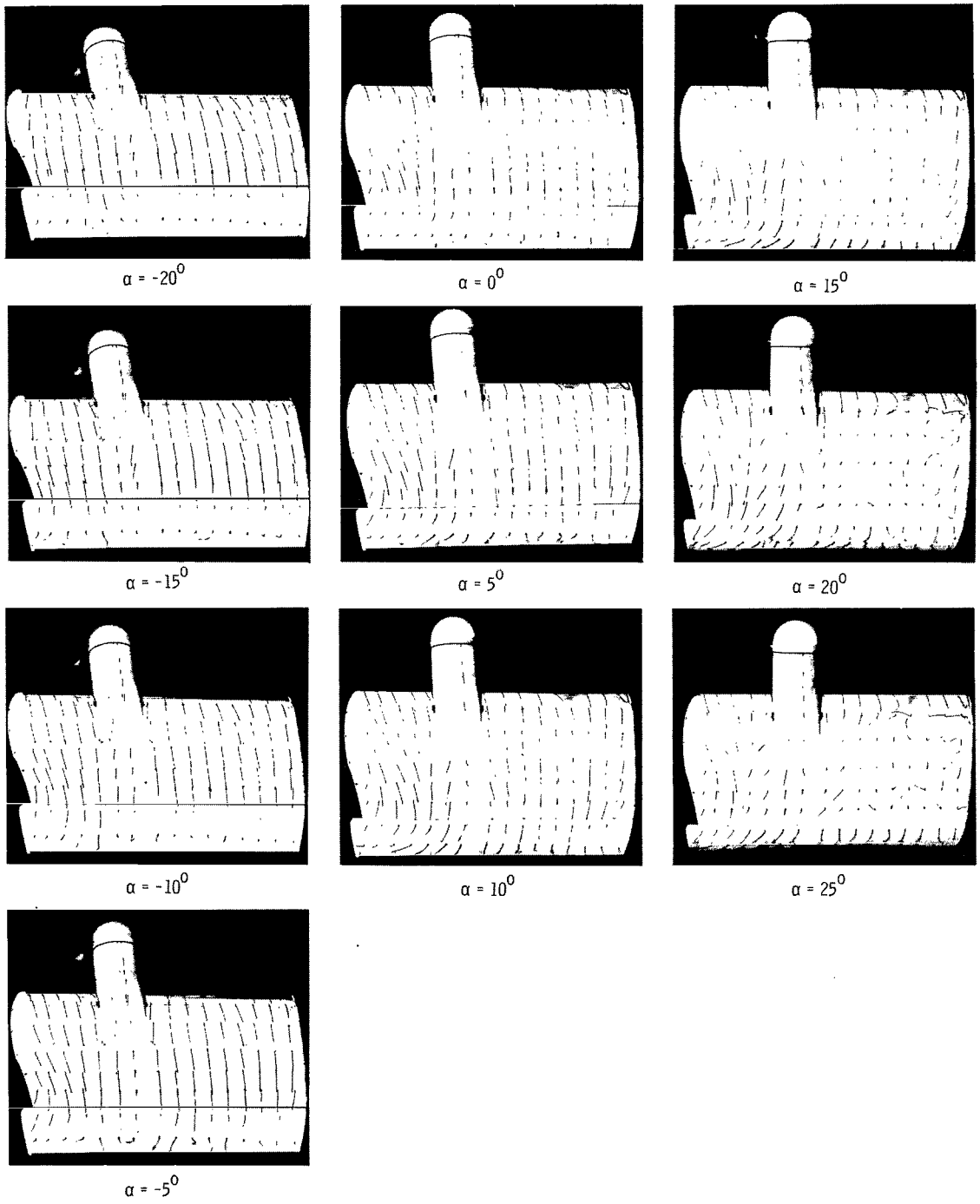
(e) Flow characteristics; $C_{T,s}$ = 0.80. L-63-7593

Figure 13.- Continued.



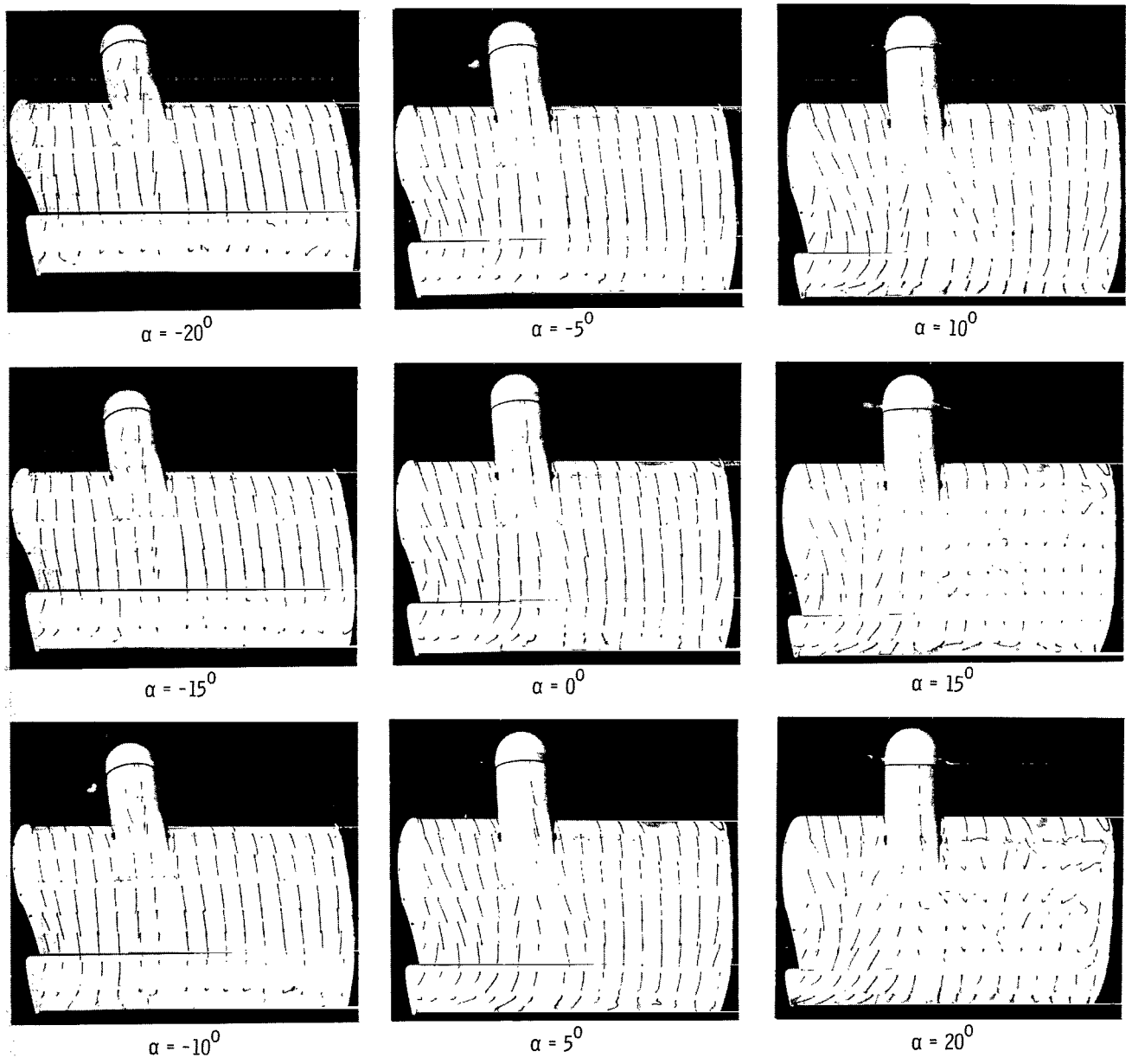
(f) Flow characteristics; $C_{T,s}$ = 0.60. L-63-7594

Figure 13.- Continued.



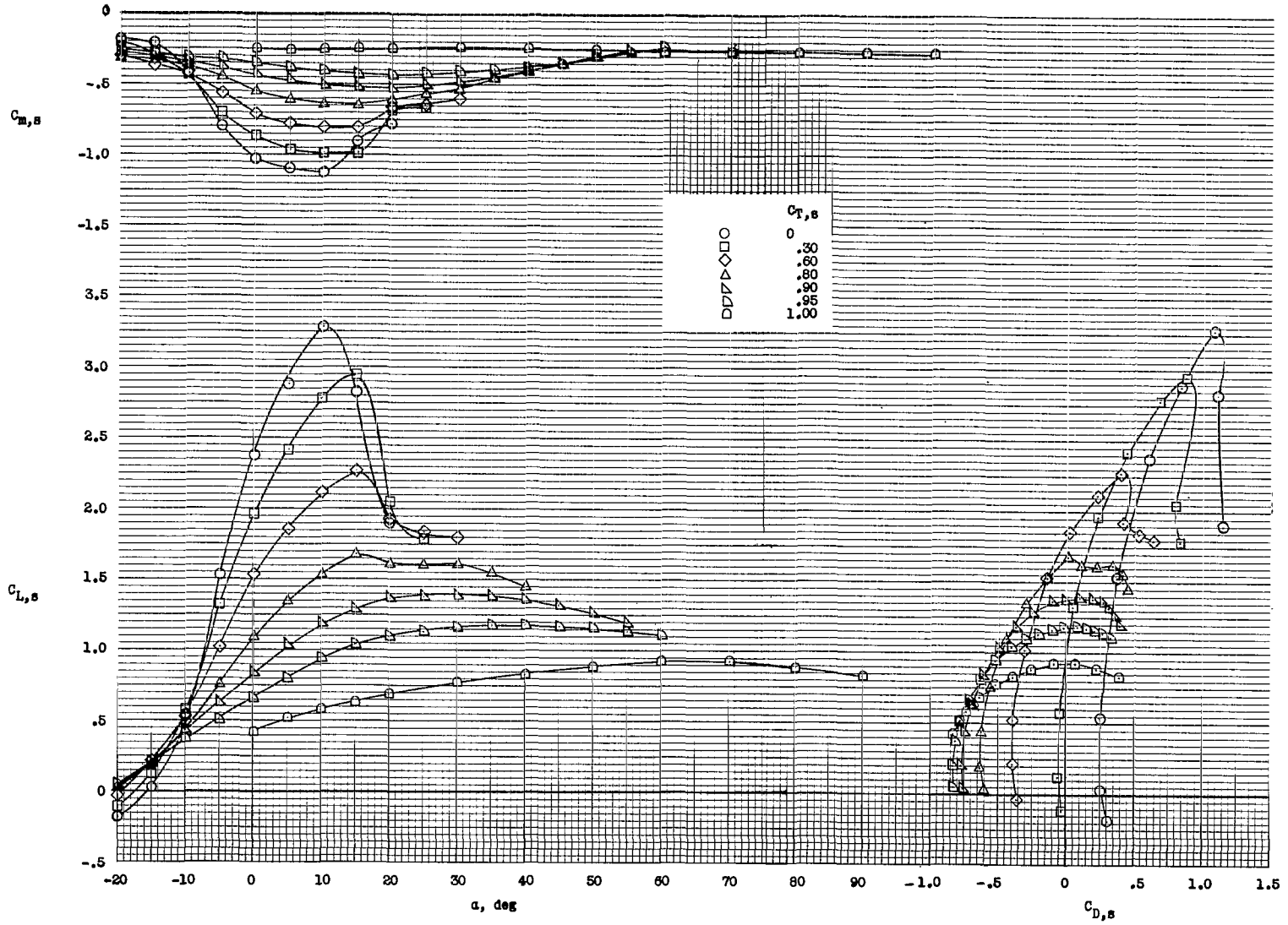
(g) Flow characteristics; $C_{T,s}$ = 0.30. L-63-7595

Figure 13.- Continued.



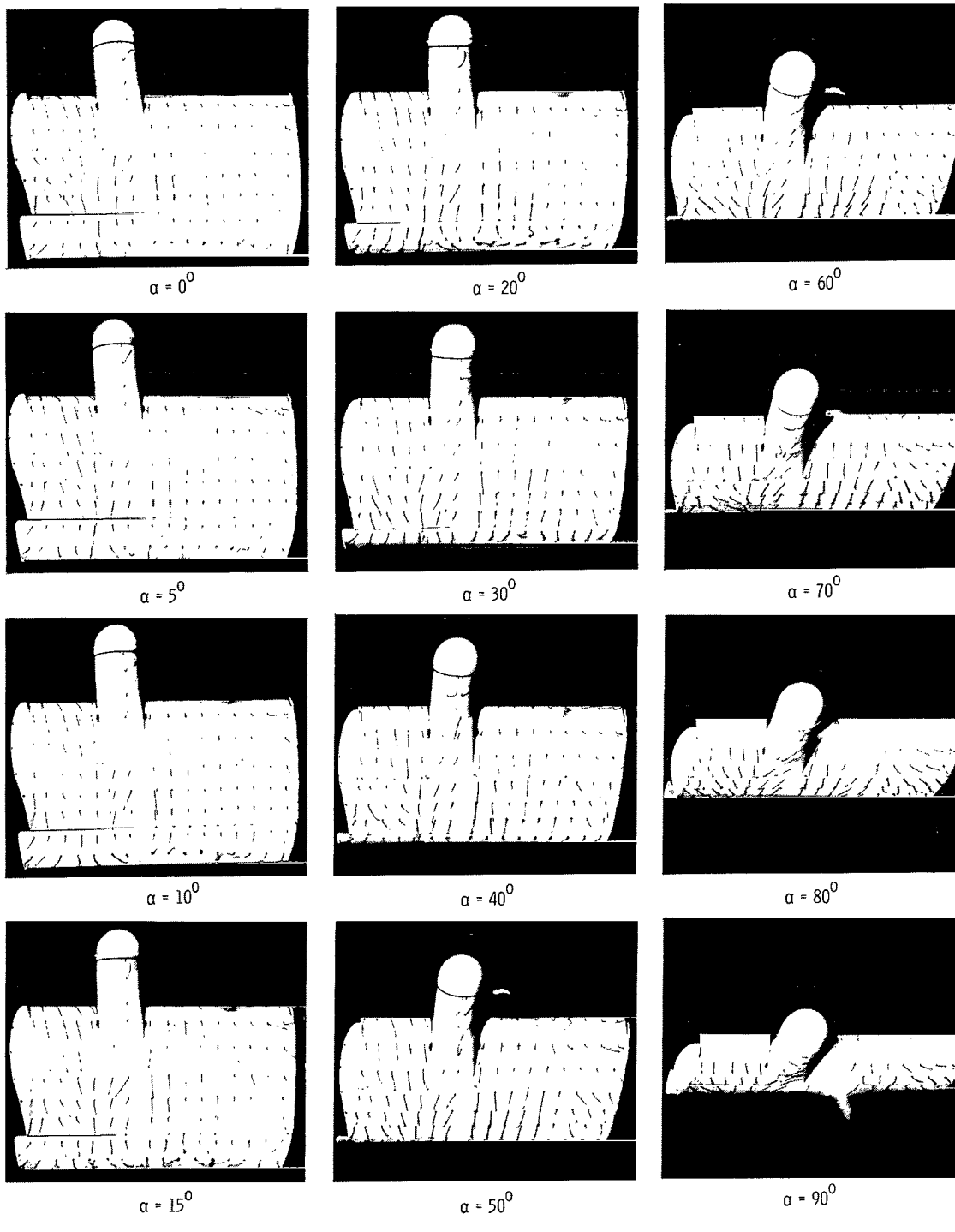
(h) Flow characteristics; $C_{T,s} = 0$. L-63-7596

Figure 13.- Concluded.



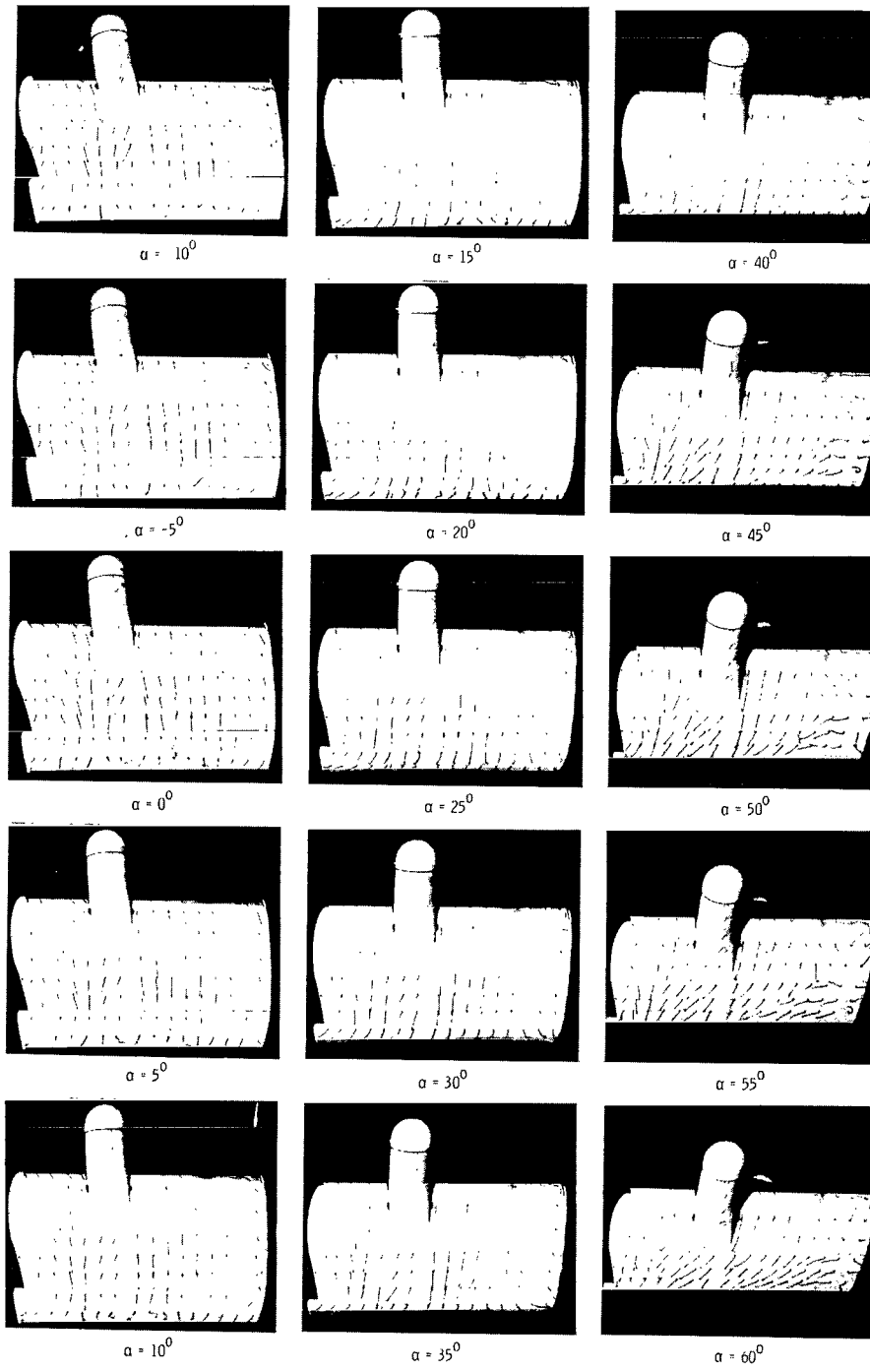
(a) Aerodynamic characteristics.

Figure 14.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and leading-edge droop deflected 30°.



(b) Flow characteristics; $C_{T,s}$ = 1.00. L-63-7597

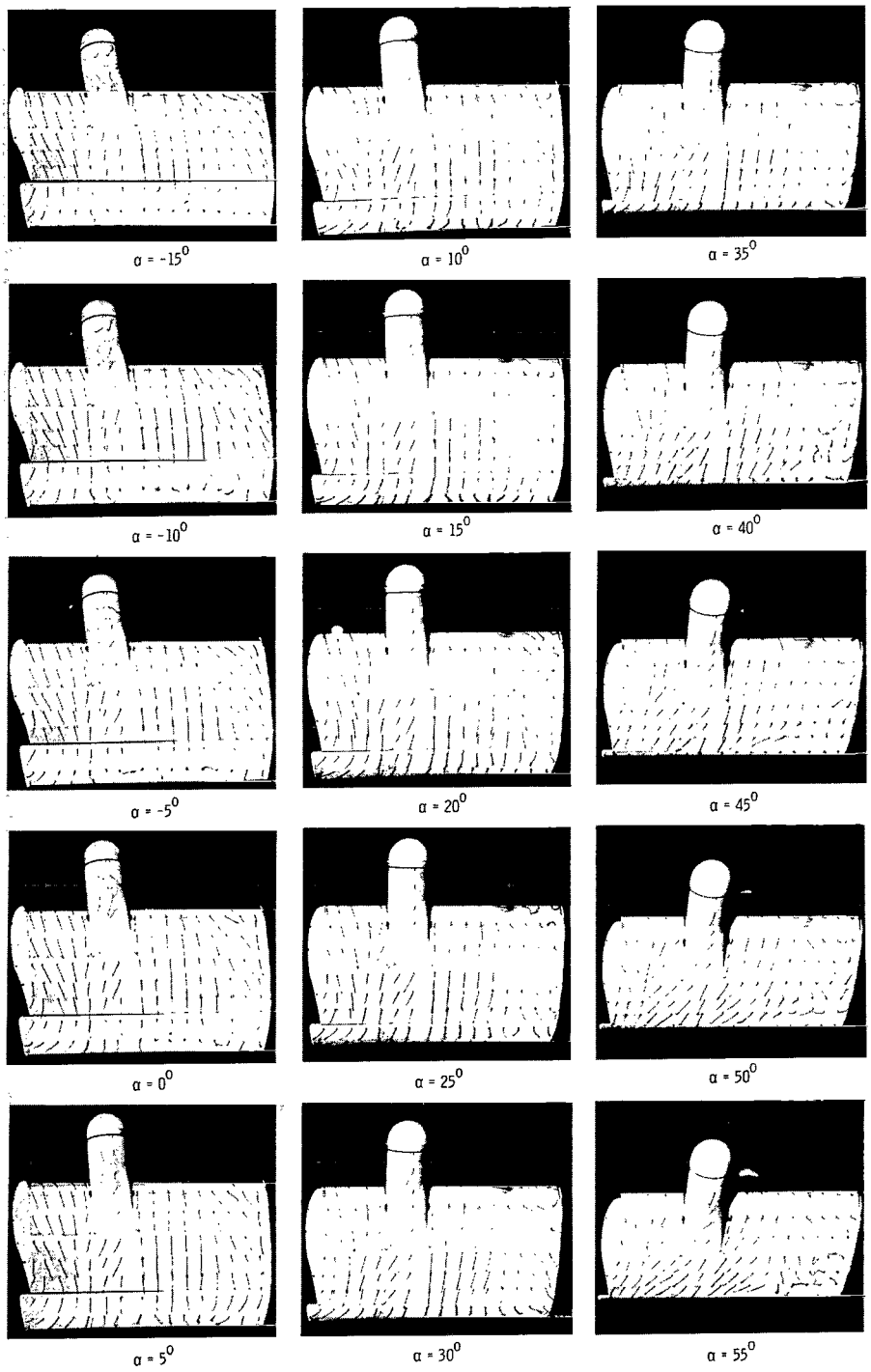
Figure 14.- Continued.



(c) Flow characteristics; $C_{T,s}$ = 0.95.

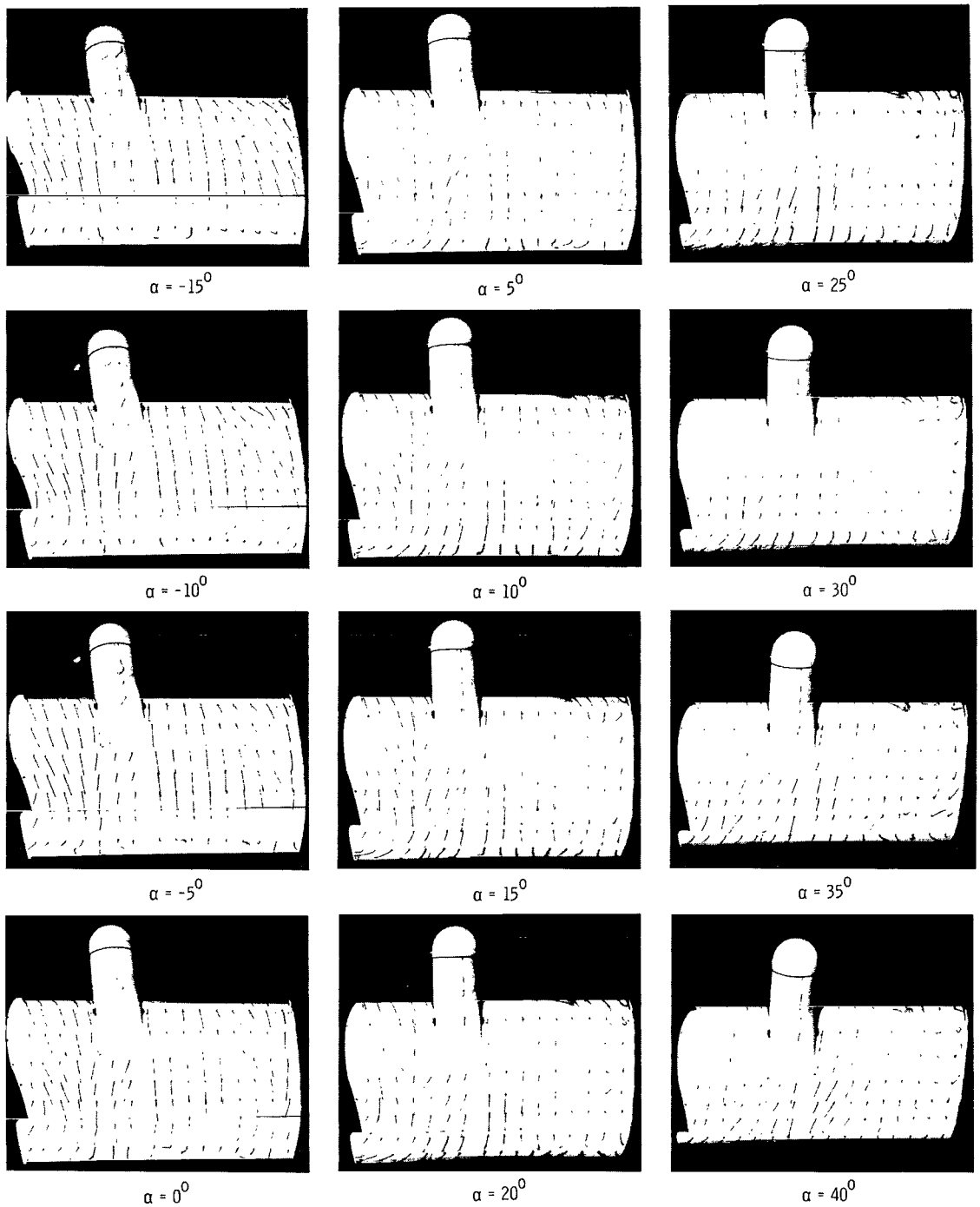
L-63-7598

Figure 14.- Continued.



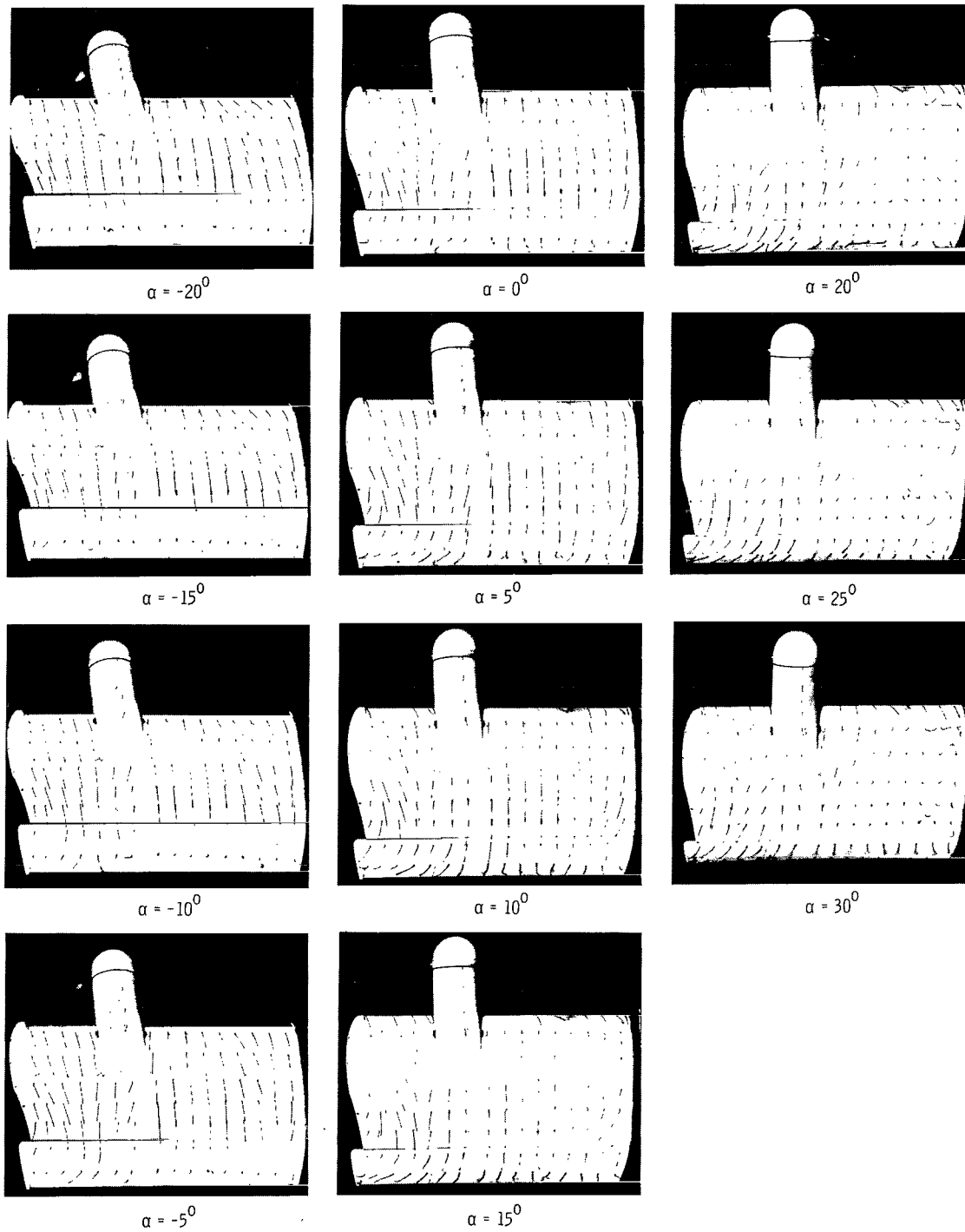
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-7599

Figure 14.- Continued.



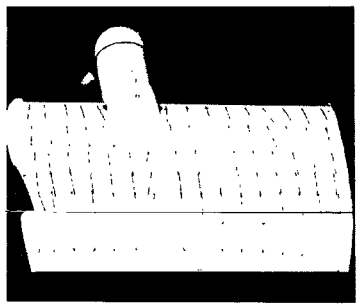
(e) Flow characteristics; $C_{T,s}$ = 0.80. L-63-7600

Figure 14.- Continued.

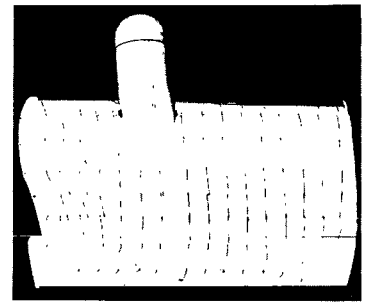


(f) Flow characteristics; $C_{T,s}$ = 0.60. L-63-9201

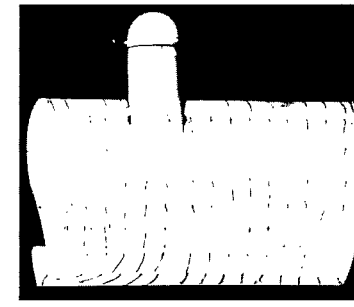
Figure 14.- Continued.



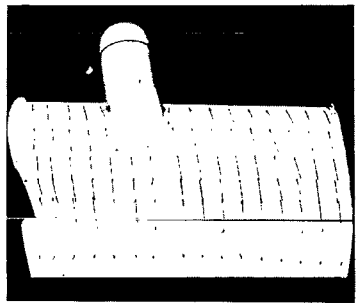
$\alpha = -20^0$



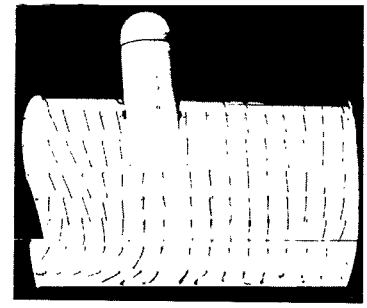
$\alpha = 0^0$



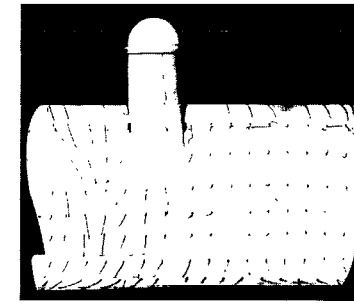
$\alpha = 15^0$



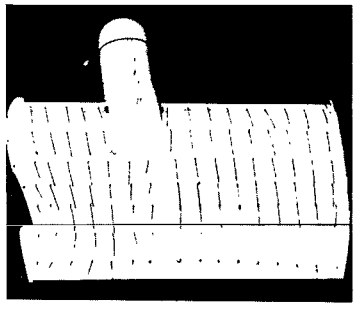
$\alpha = -15^0$



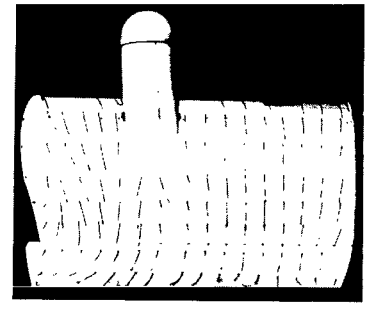
$\alpha = 5^0$



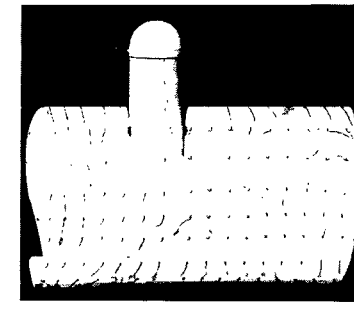
$\alpha = 20^0$



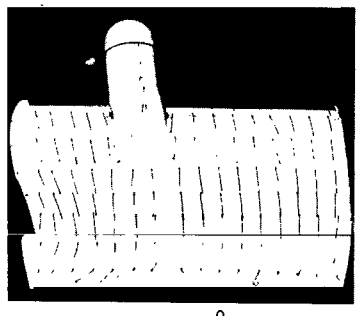
$\alpha = -10^0$



$\alpha = 10^0$



$\alpha = 25^0$

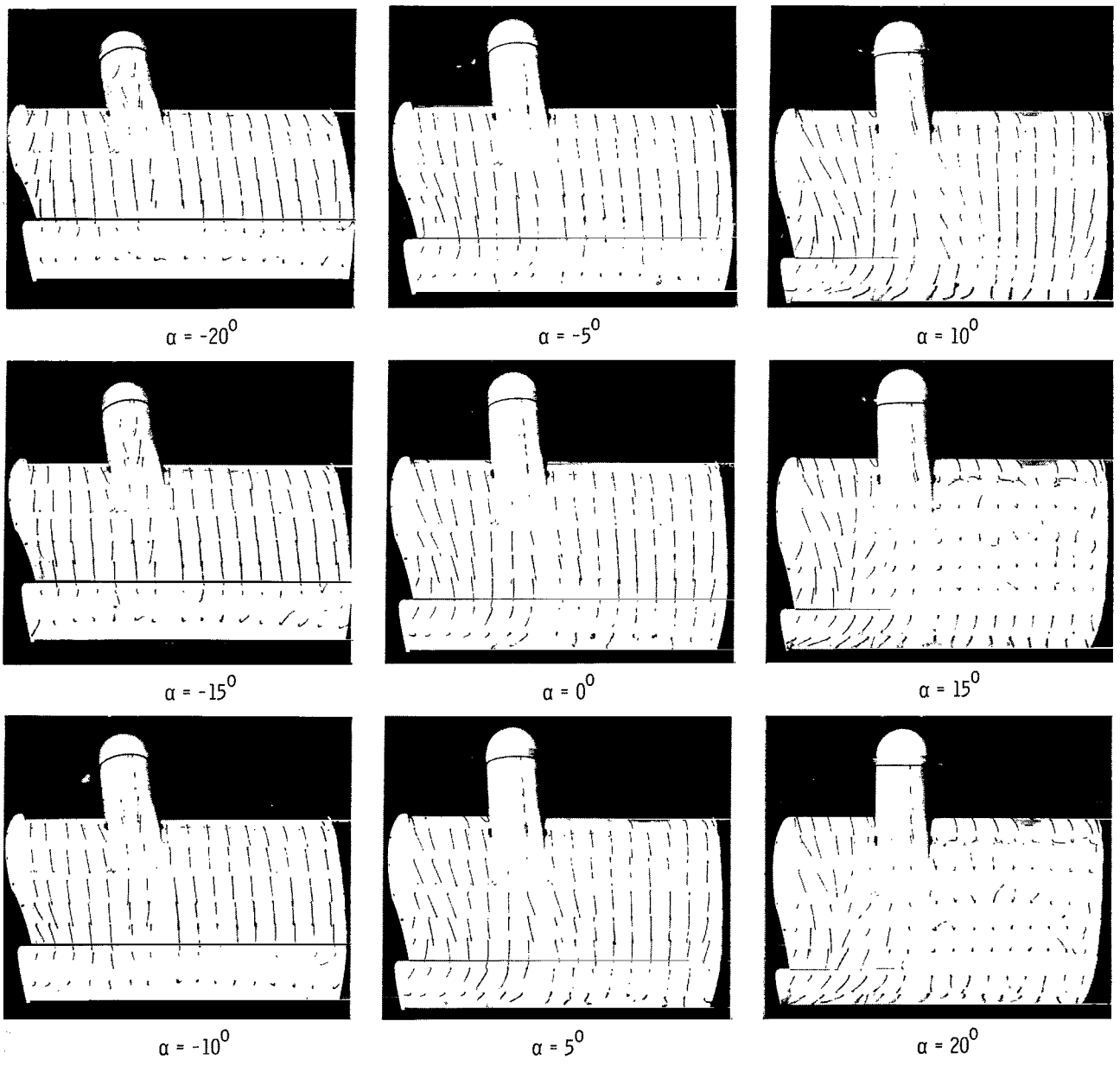


$\alpha = -5^0$

(g) Flow characteristics; $C_{T,s} = 0.30$.

L-63-9202

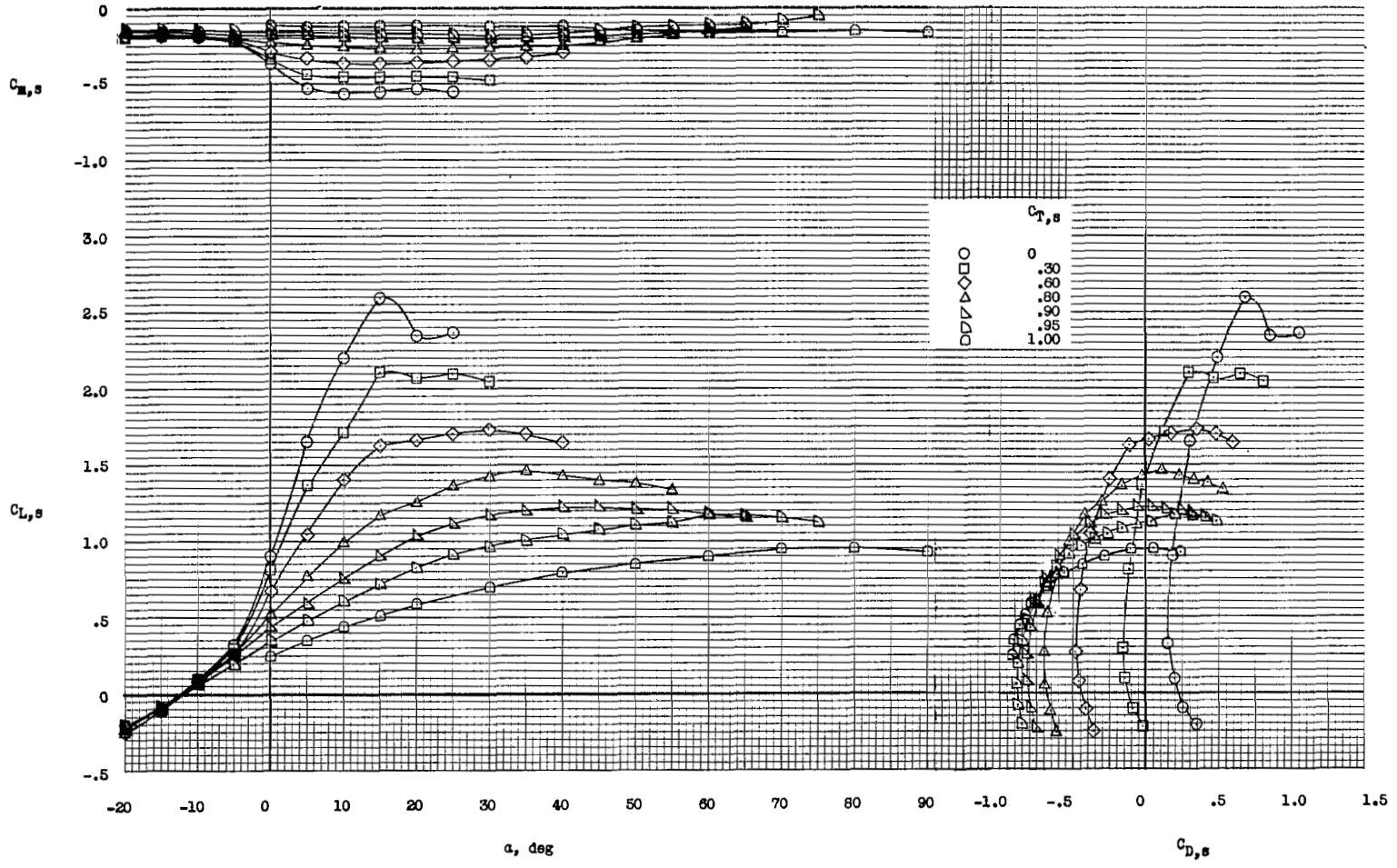
Figure 14.- Continued.



(h) Flow characteristics; $C_{T,s} = 0$.

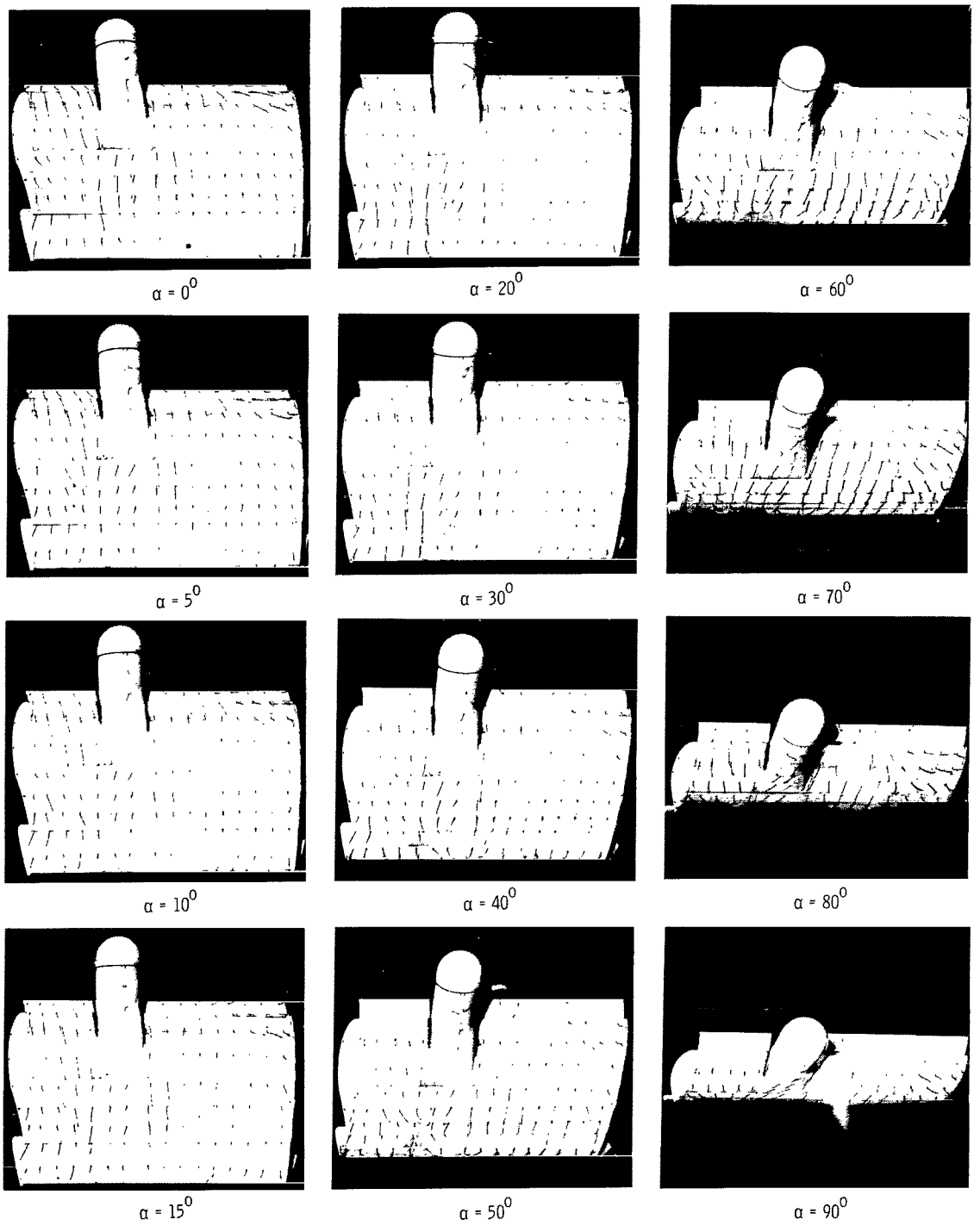
L-63-9203

Figure 14.- Concluded.



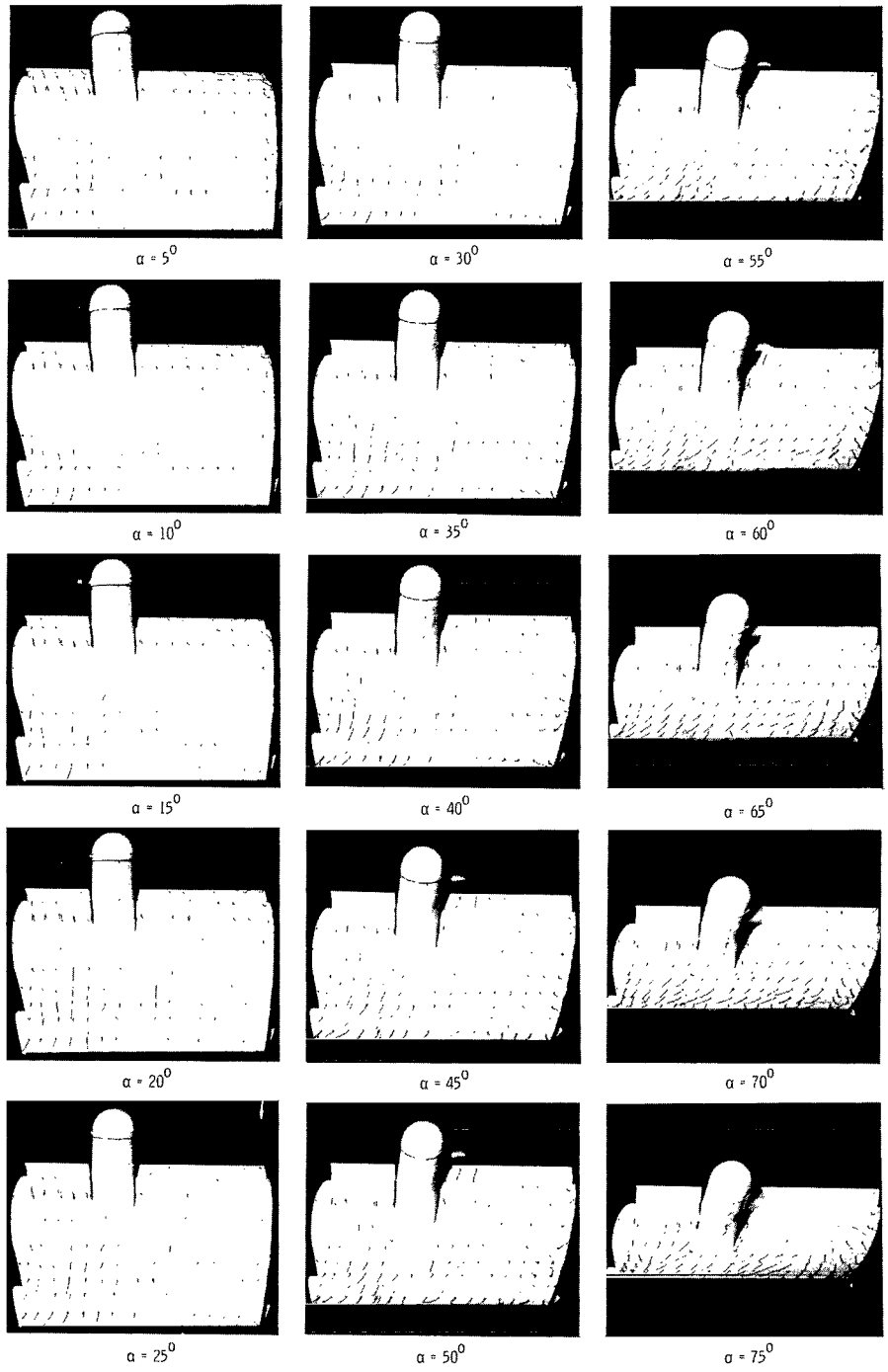
(a) Aerodynamic characteristics.

Figure 15.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 20° and with a Krueger leading-edge flap deflected 30°.



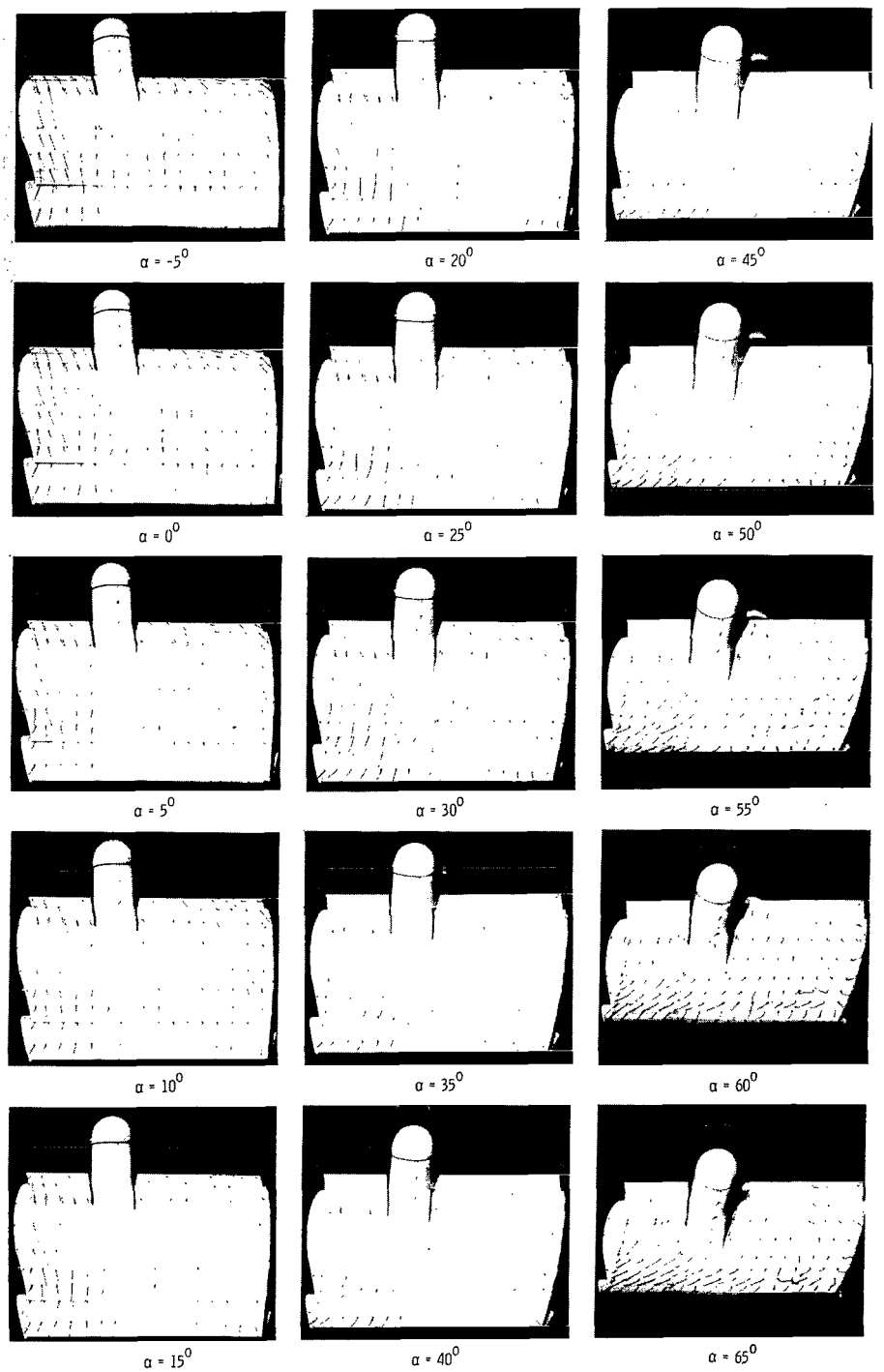
(b) Flow characteristics; $C_{T,s}$ = 1.00. L-63-9204

Figure 15.- Continued.



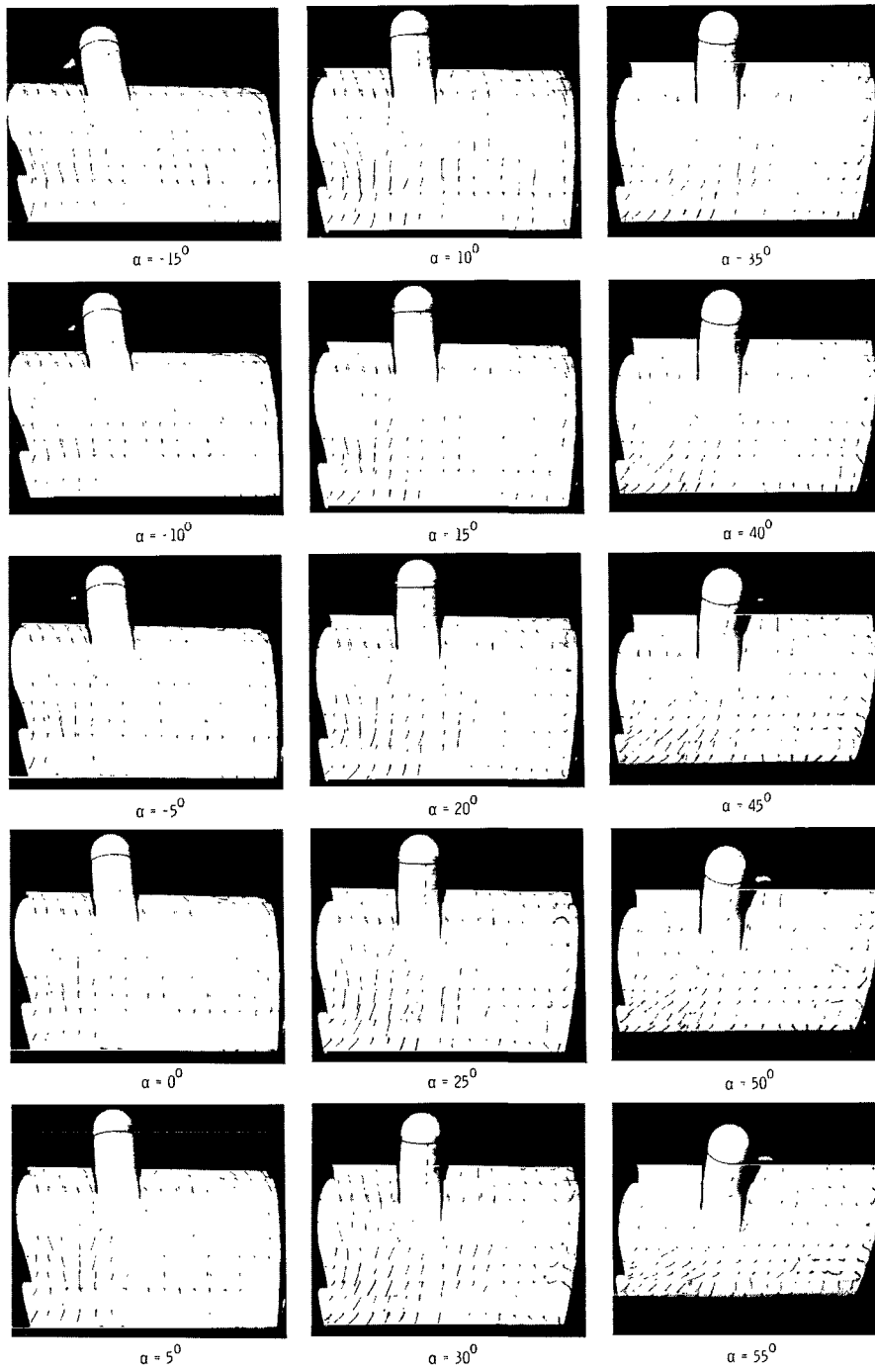
(c) Flow characteristics; $C_{T,s} = 0.95$. L-63-9205

Figure 15.- Continued.



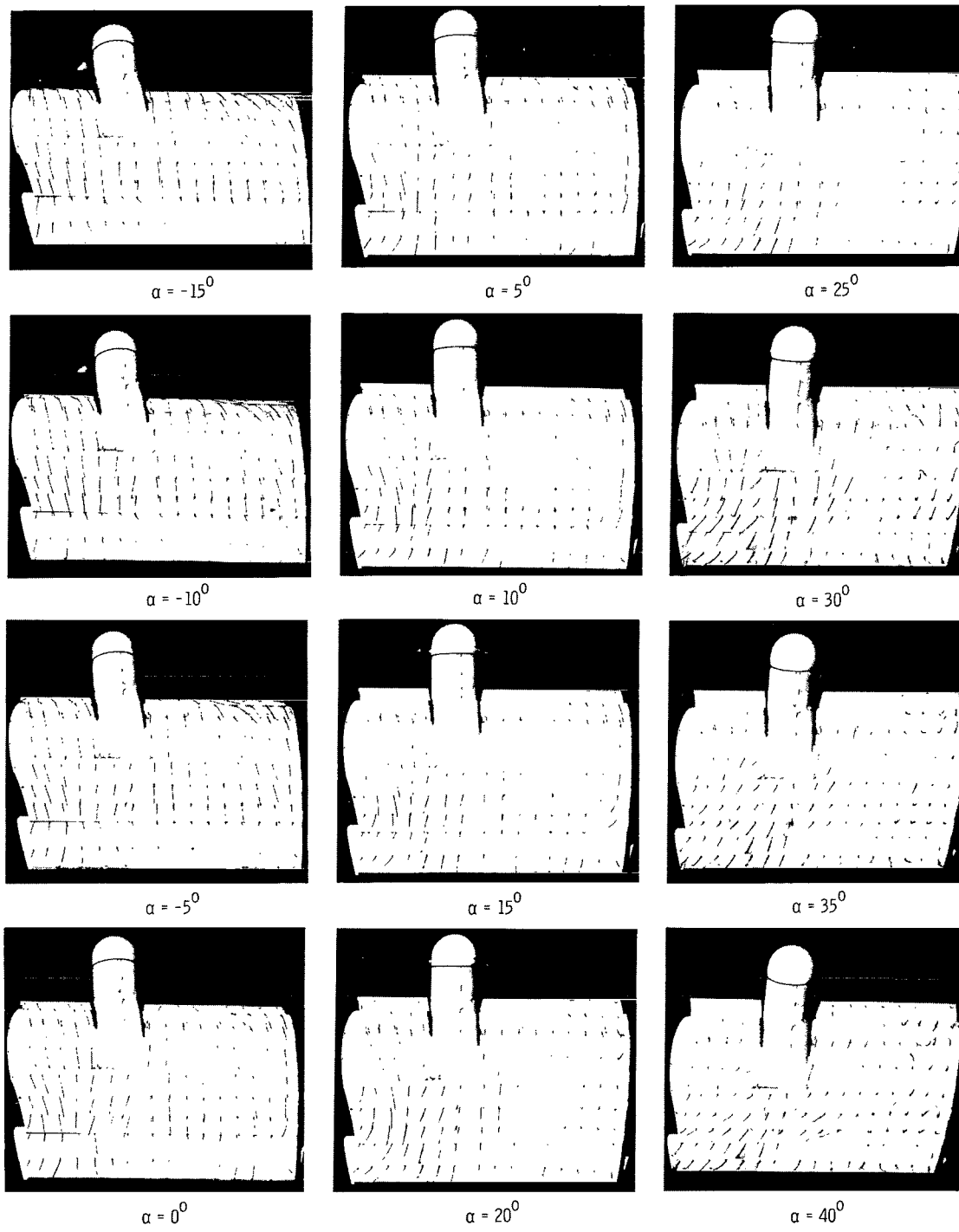
(d) Flow characteristics; $C_{T,s}$ = 0.90. L-63-9206

Figure 15.- Continued.



(e) Flow characteristics; $C_{T,s}$ = 0.80. L-63-9207

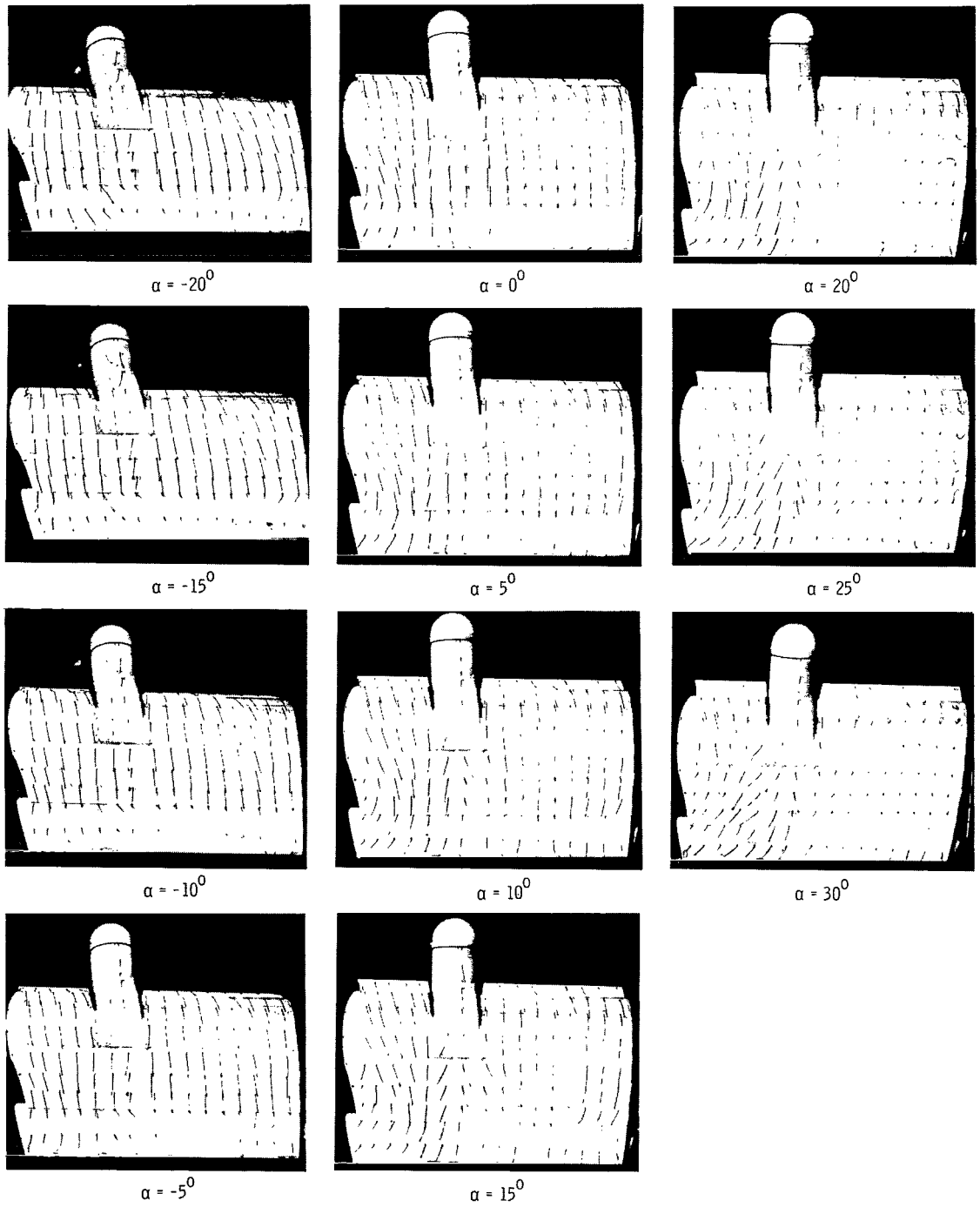
Figure 15.- Continued.



(f) Flow characteristics; $C_{T,s} = 0.60$.

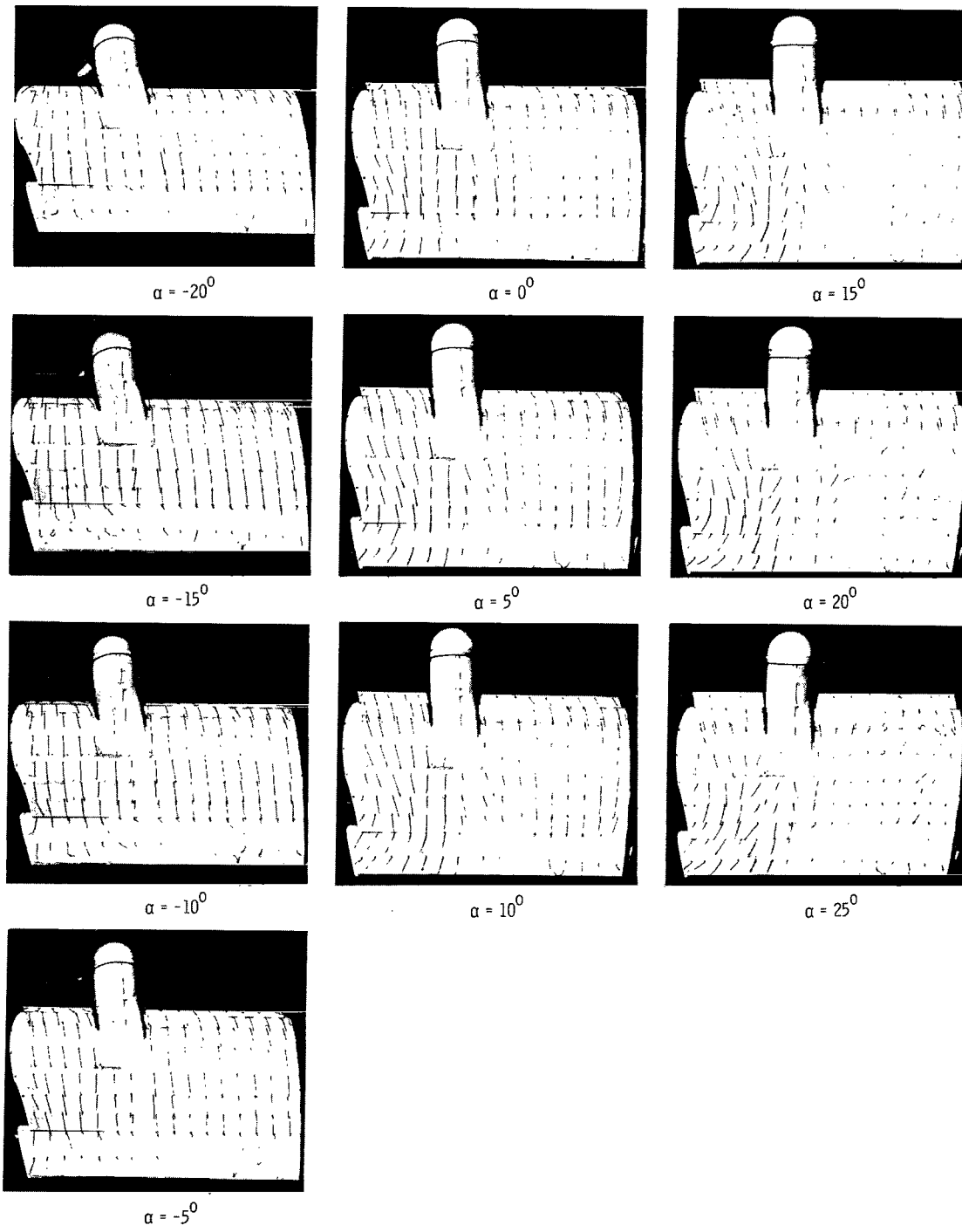
L-63-9208

Figure 15.- Continued.



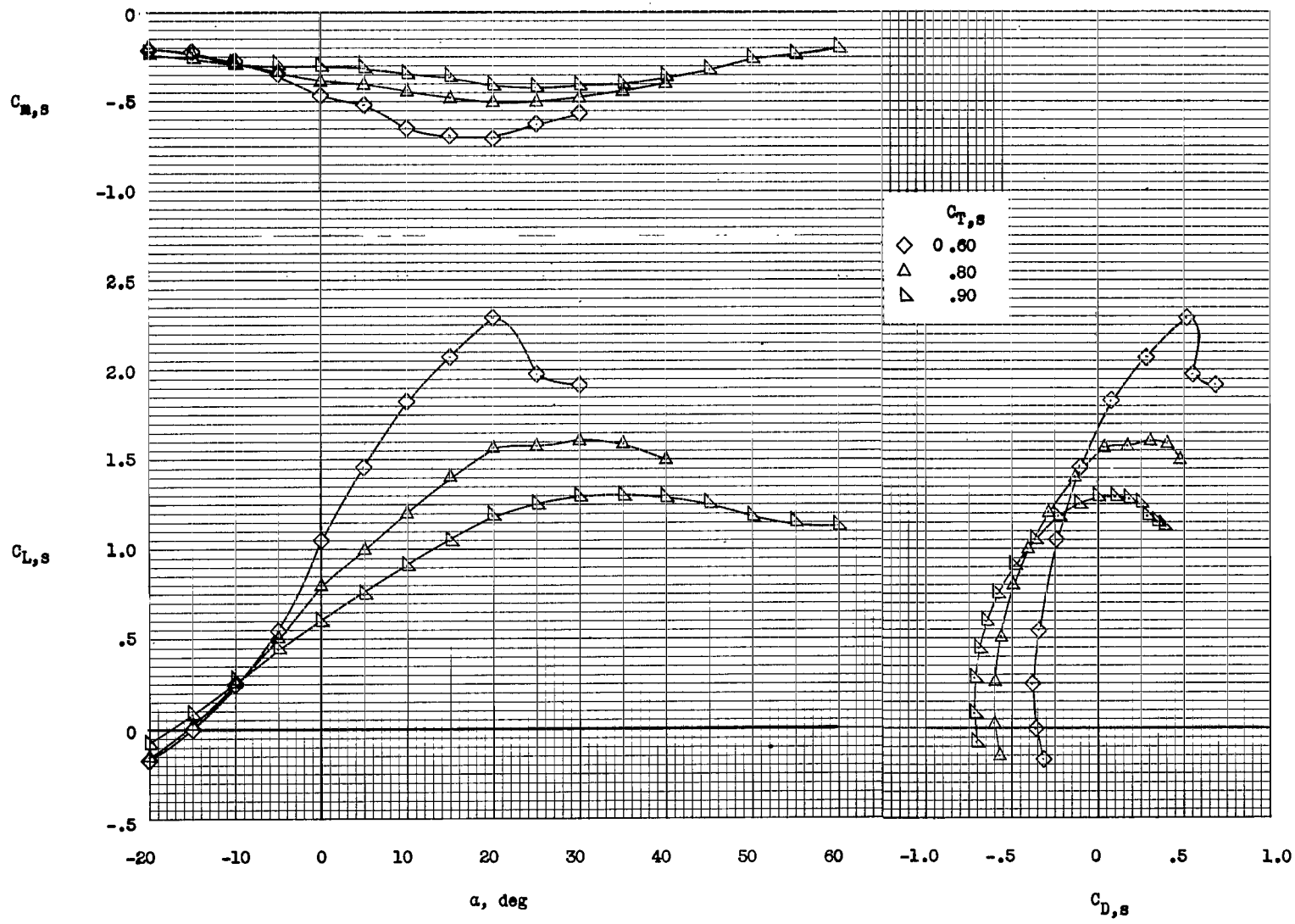
(g) Flow characteristics; $C_{T,s}$ = 0.30. L-63-9209

Figure 15.- Continued.



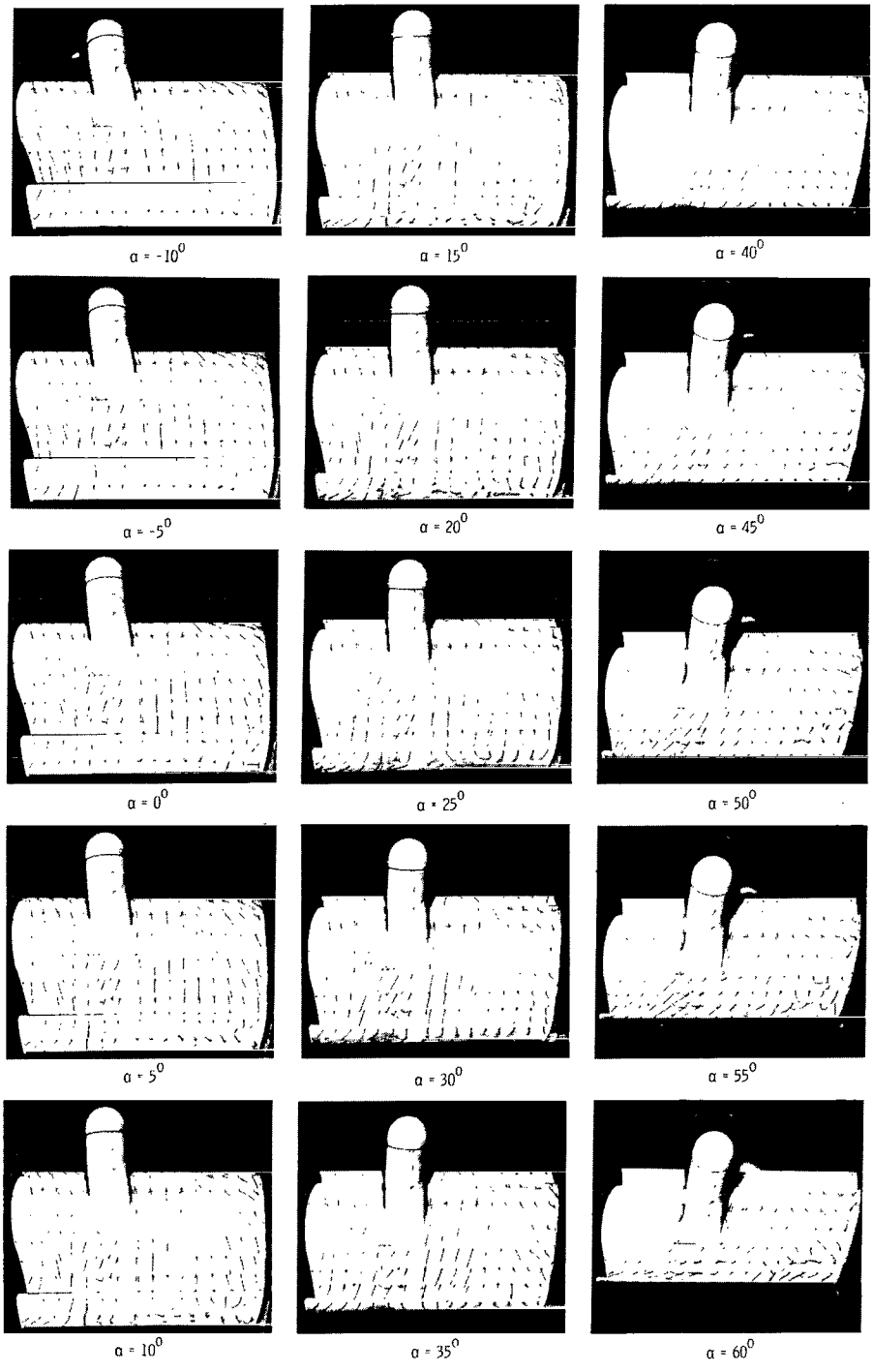
(h) Flow characteristics; $C_{T,s} = 0$. L-63-9210

Figure 15.- Concluded.



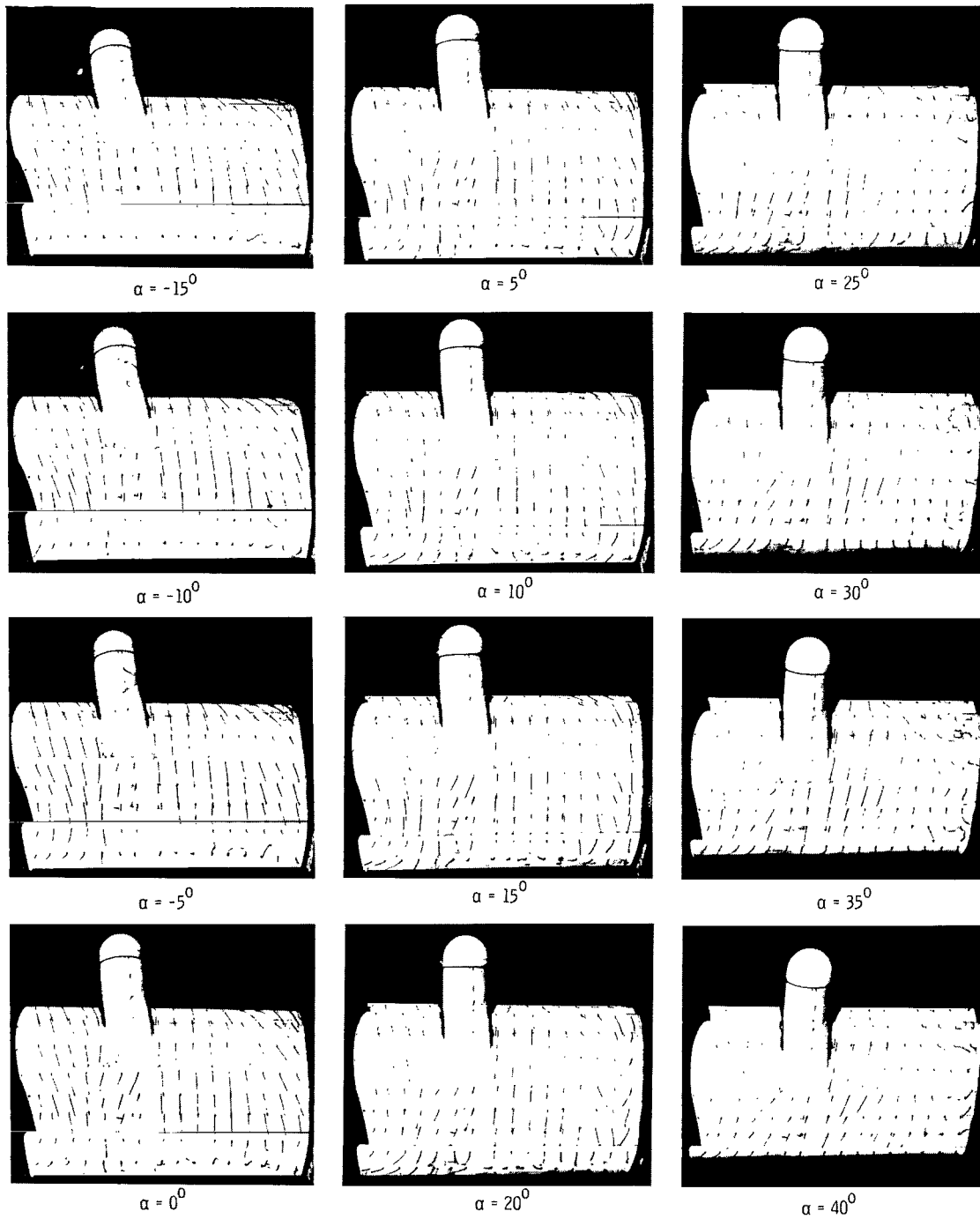
(a) Aerodynamic characteristics.

Figure 16.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and with a Krueger leading-edge flap deflected 50°.



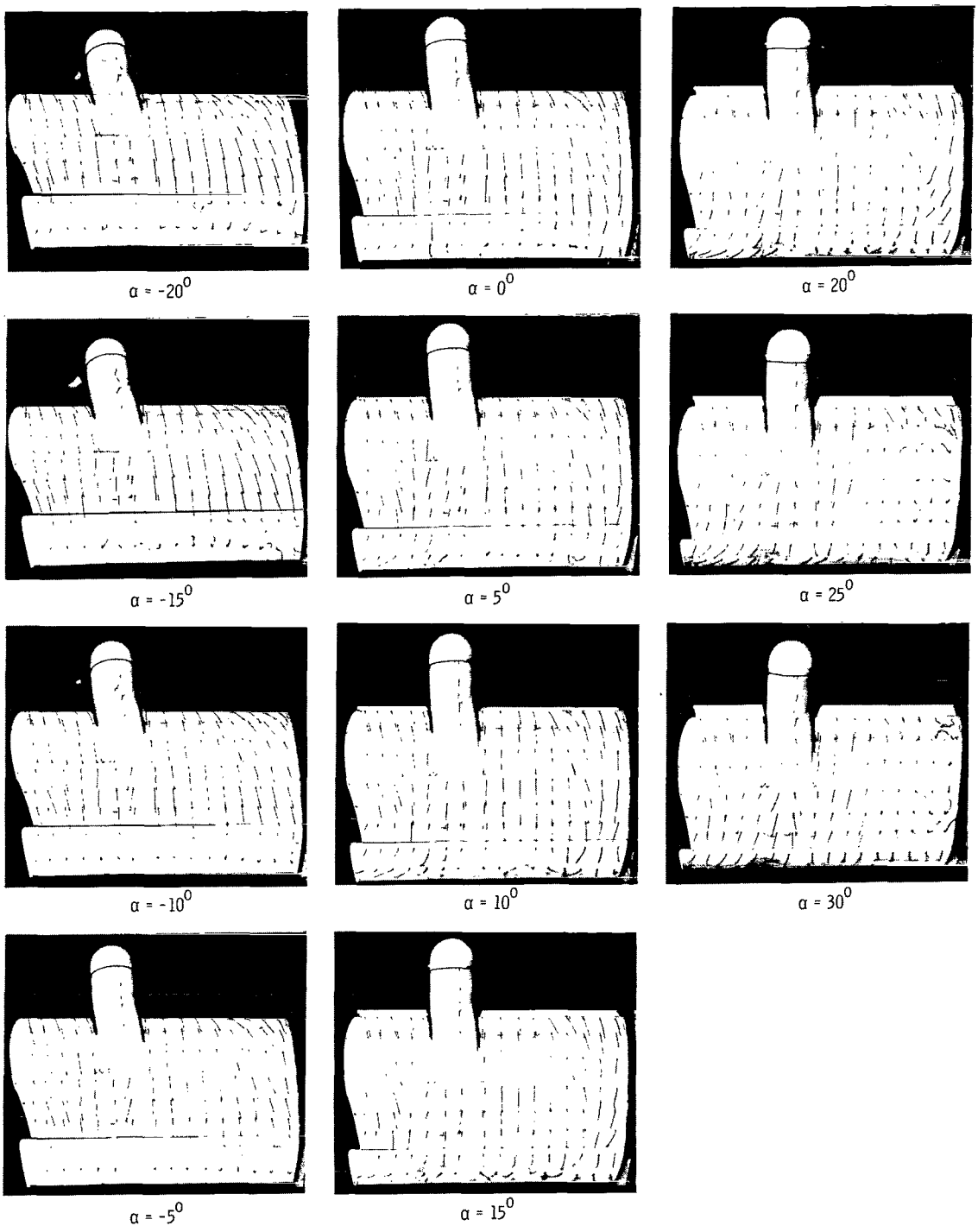
(b) Flow characteristics; $C_{T,s}$ = 0.90. L-63-9211

Figure 16.- Continued.



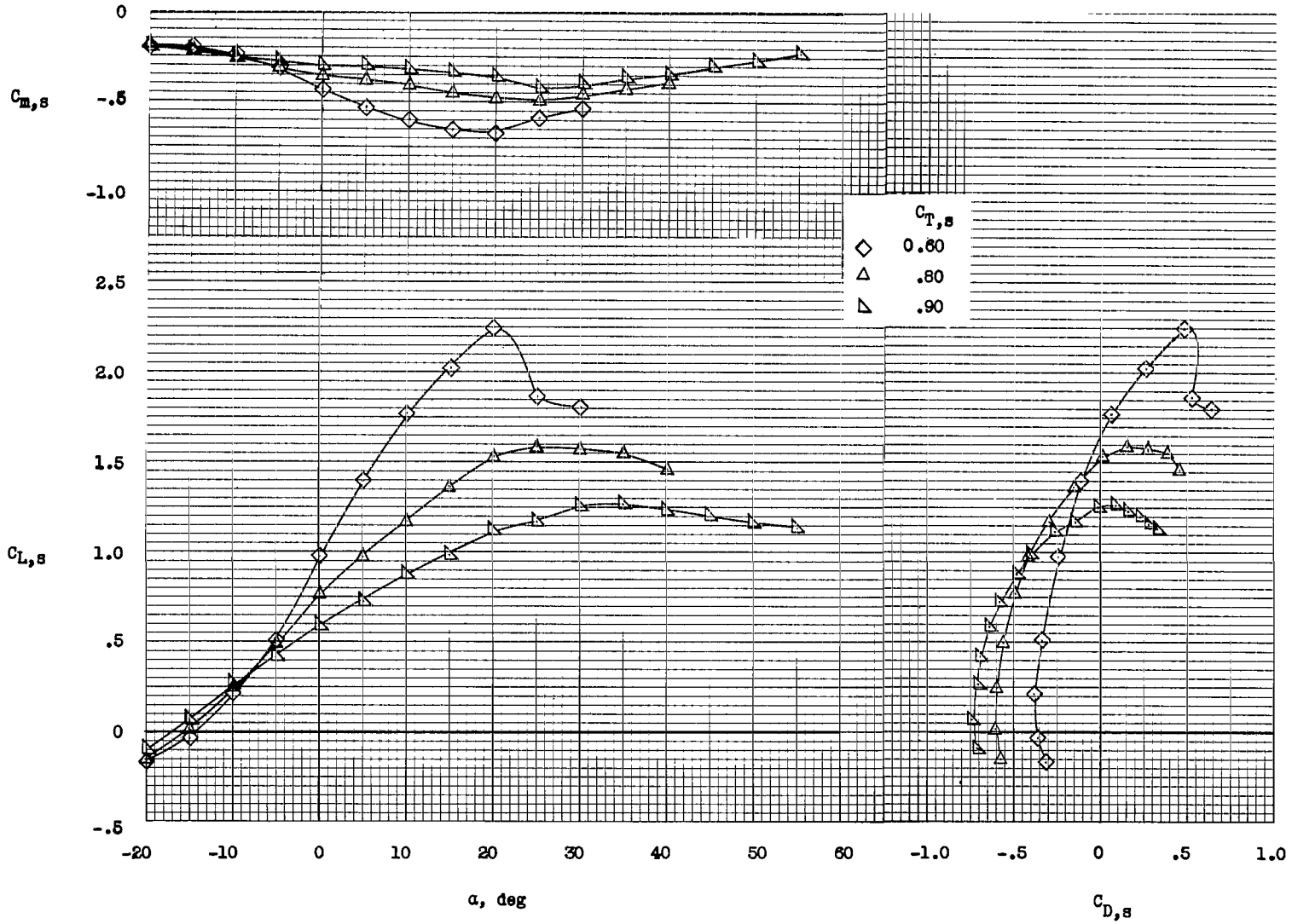
(c) Flow characteristics; $C_{T,s}$ = 0.80. L-63-9212

Figure 16.- Continued.



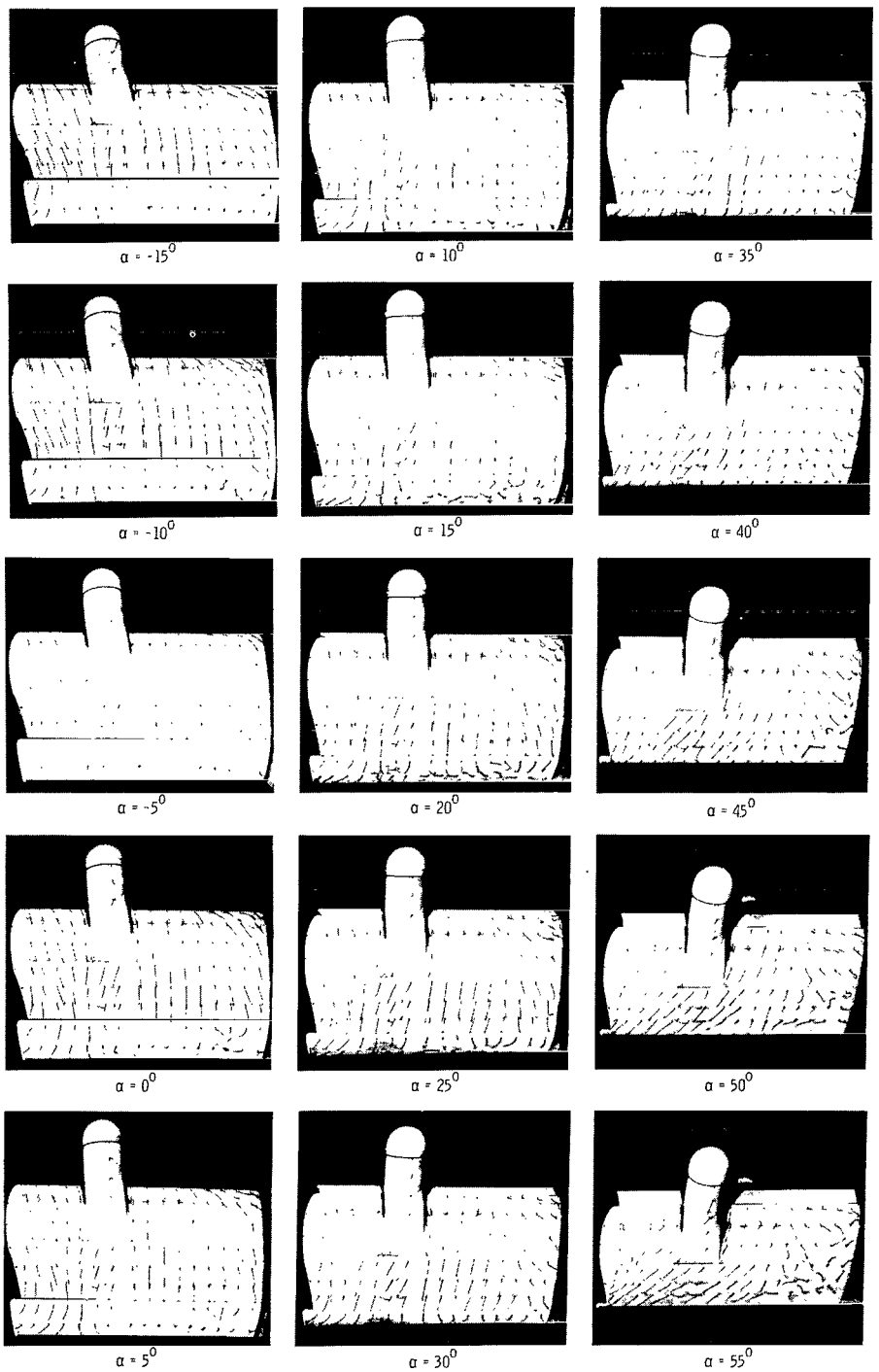
(d) Flow characteristics; $C_{T,s}$ = 0.60. L-63-9213

Figure 16.- Concluded.



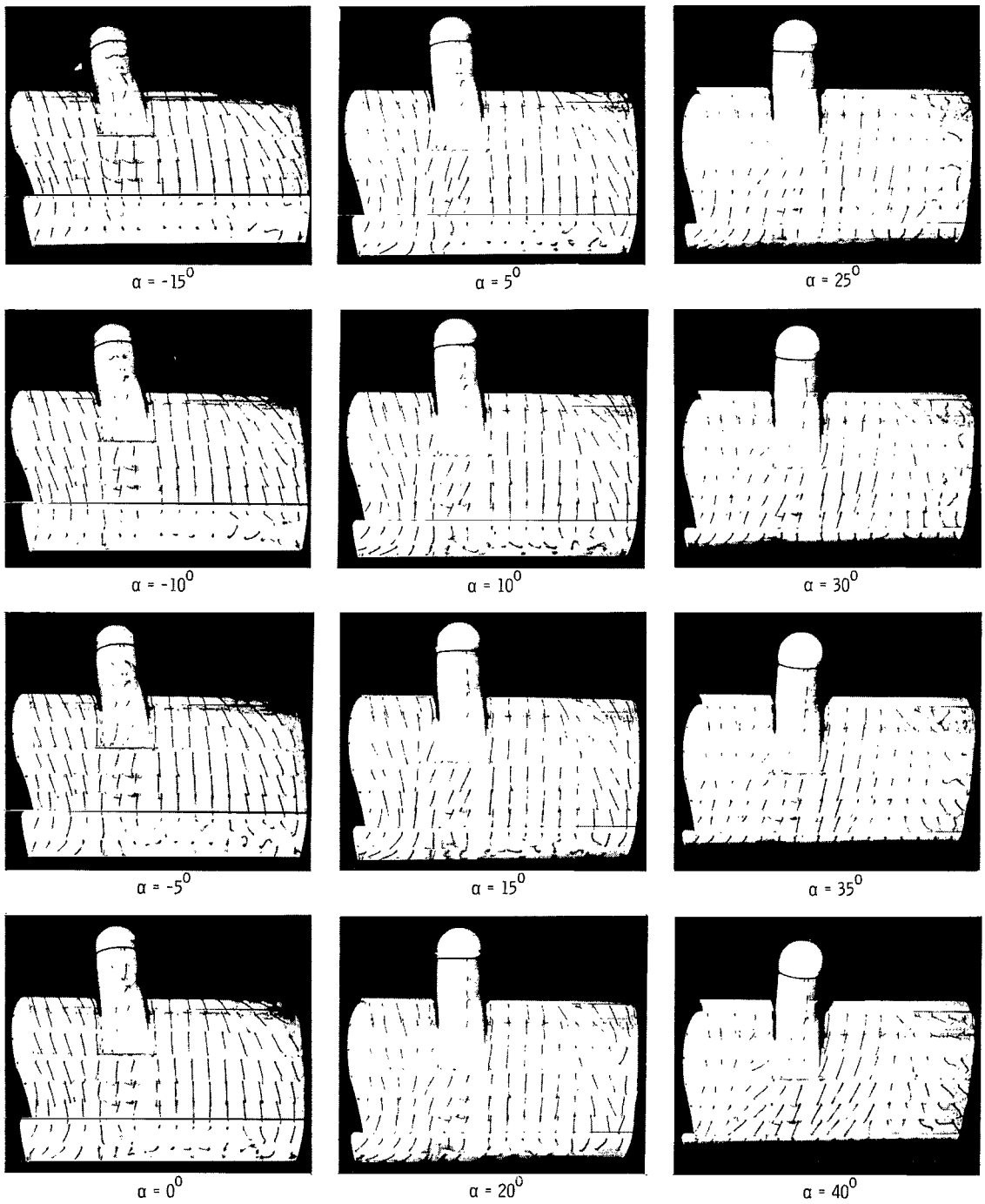
(a) Aerodynamic characteristics.

Figure 17.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and with a Krueger leading-edge flap deflected 60°.



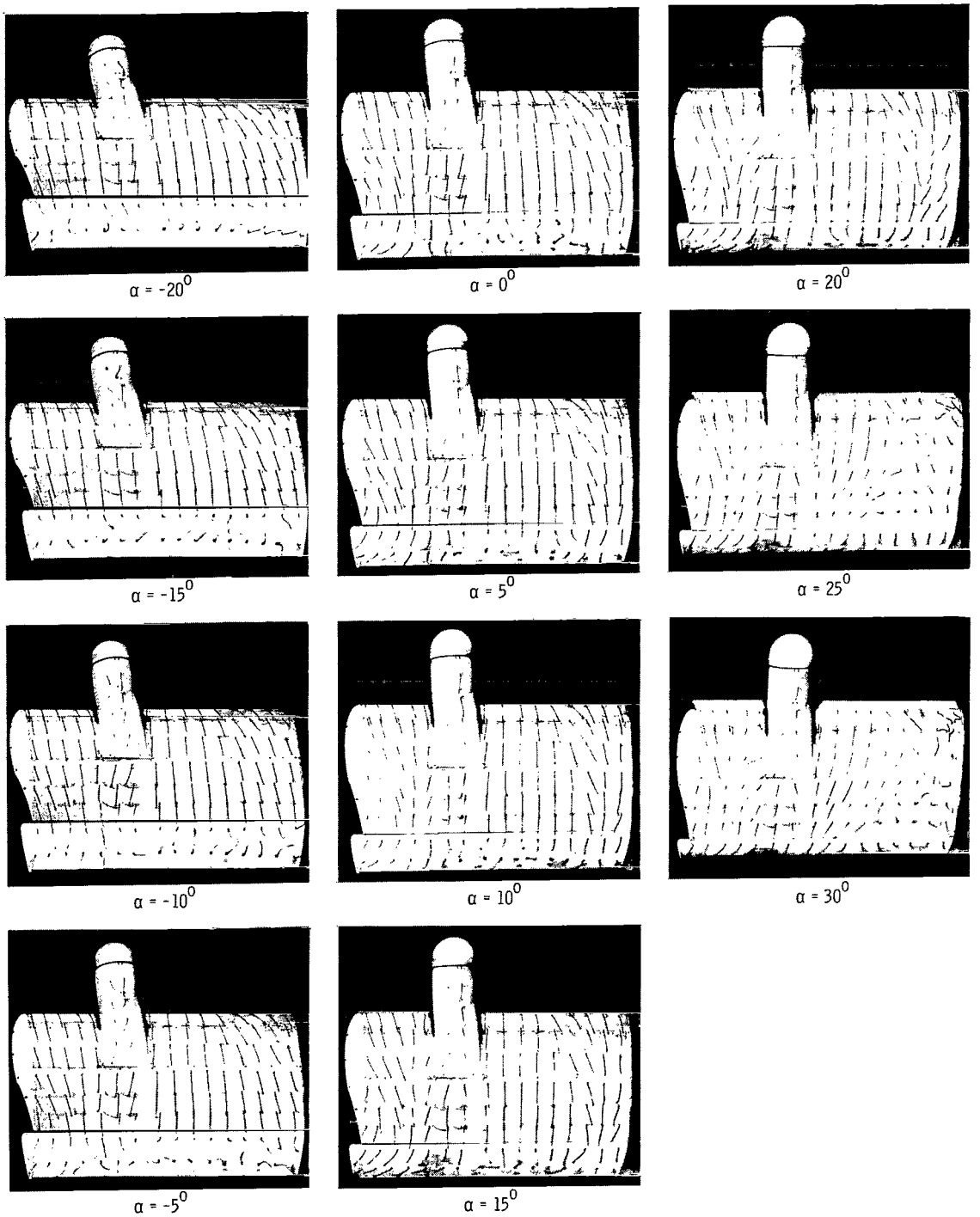
(b) Flow characteristics; $C_{T,s}$ = 0.90. L-63-9214

Figure 17.- Continued.



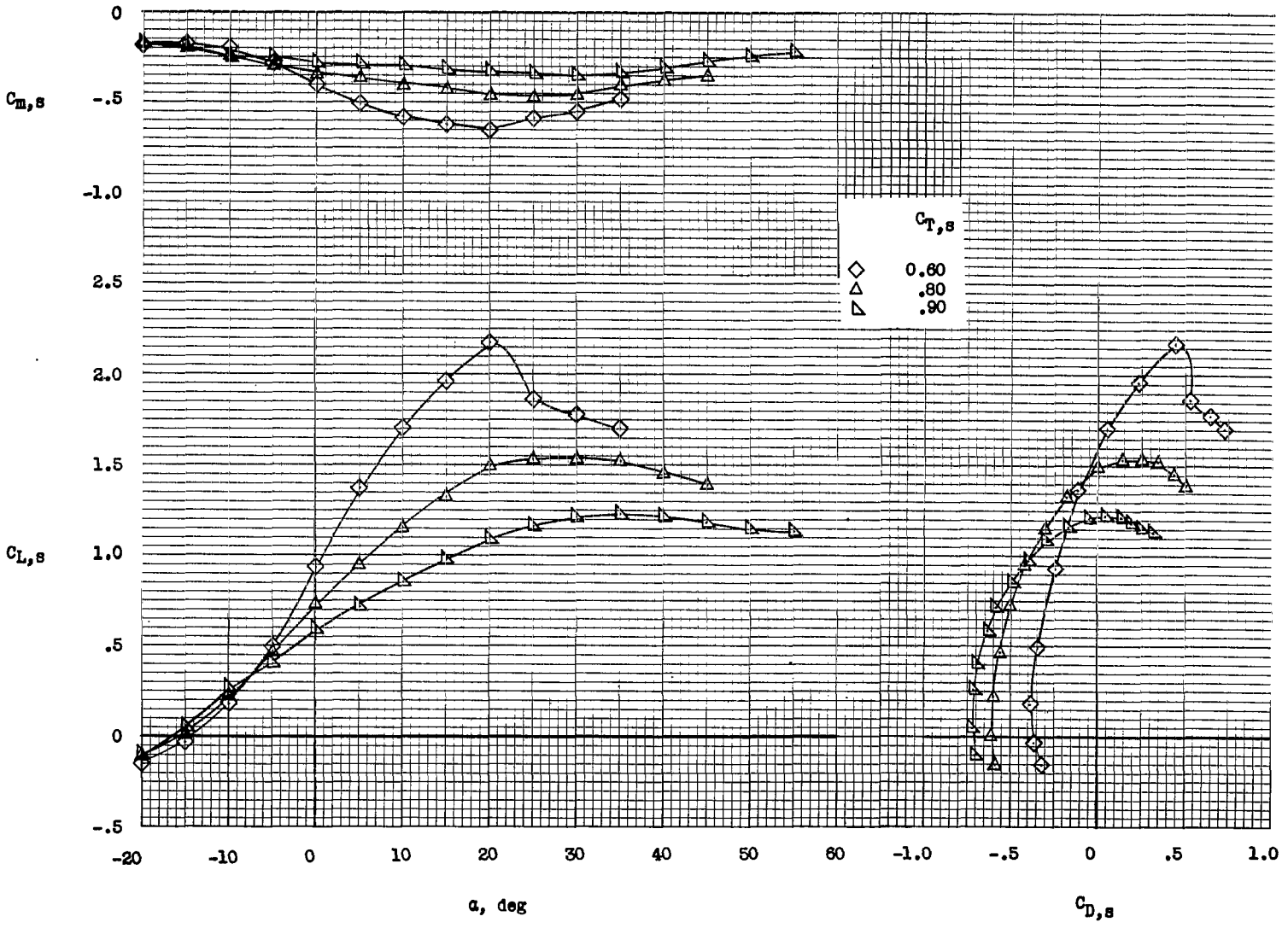
(c) Flow characteristics; $C_{T,s}$ = 0.80. L-63-9215

Figure 17.- Continued.



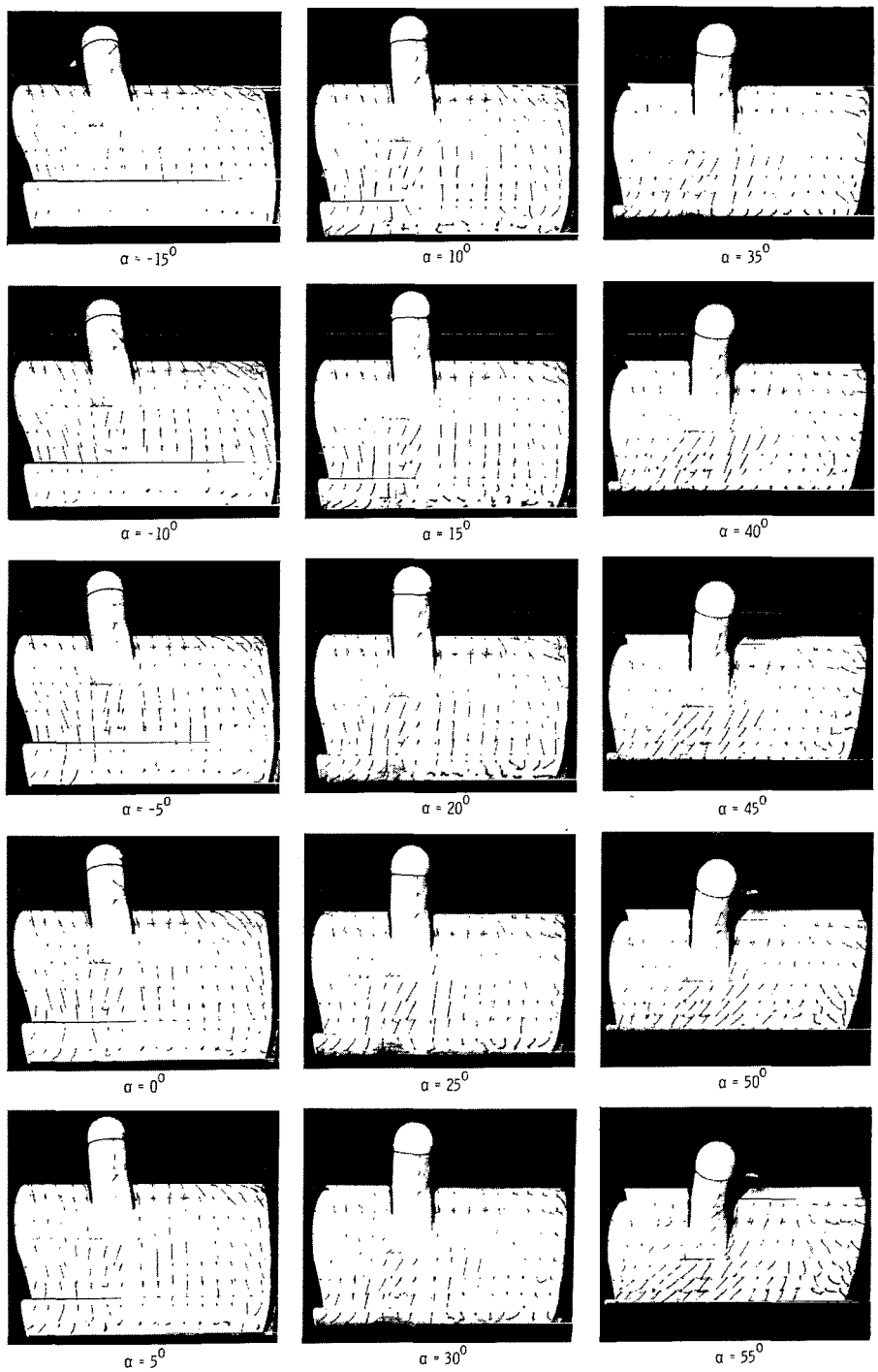
(d) Flow characteristics; $C_{T,s}$ = 0.60. L-63-9216

Figure 17.- Concluded.



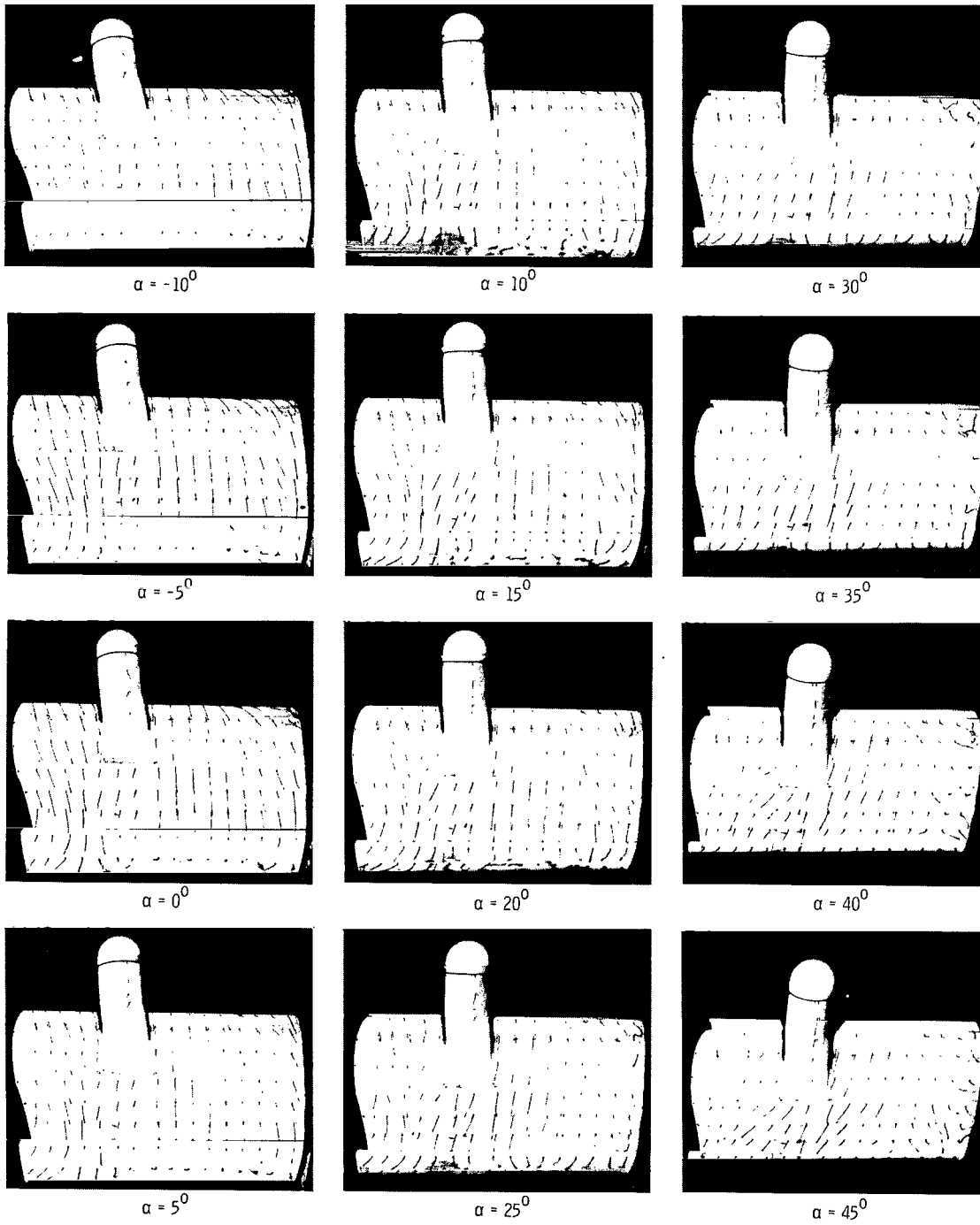
(a) Aerodynamic characteristics.

Figure 18.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and with a Krueger leading-edge flap deflected 70°.



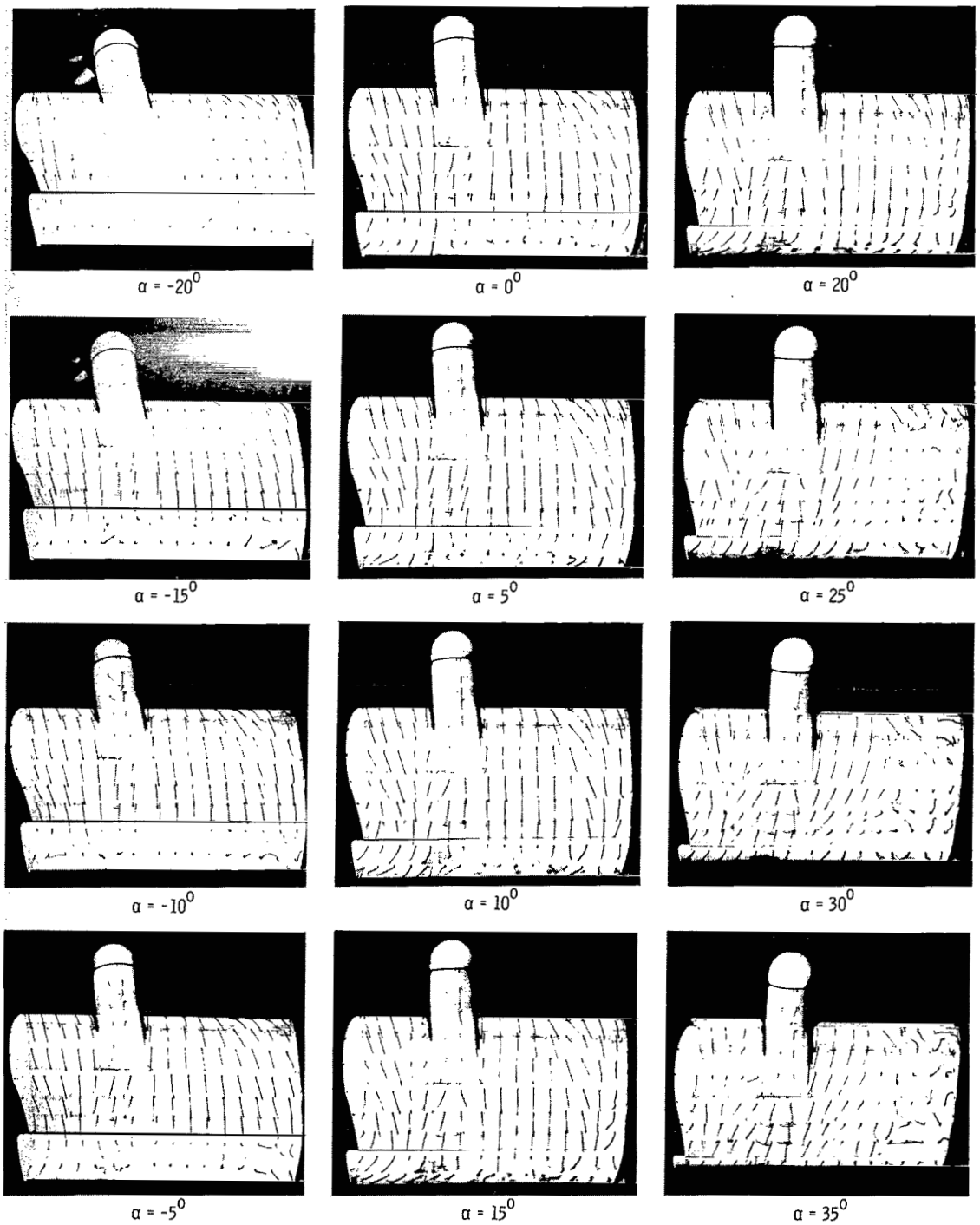
(b) Flow characteristics; $C_{T,s} = 0.90$. L-63-9217

Figure 18.- Continued.



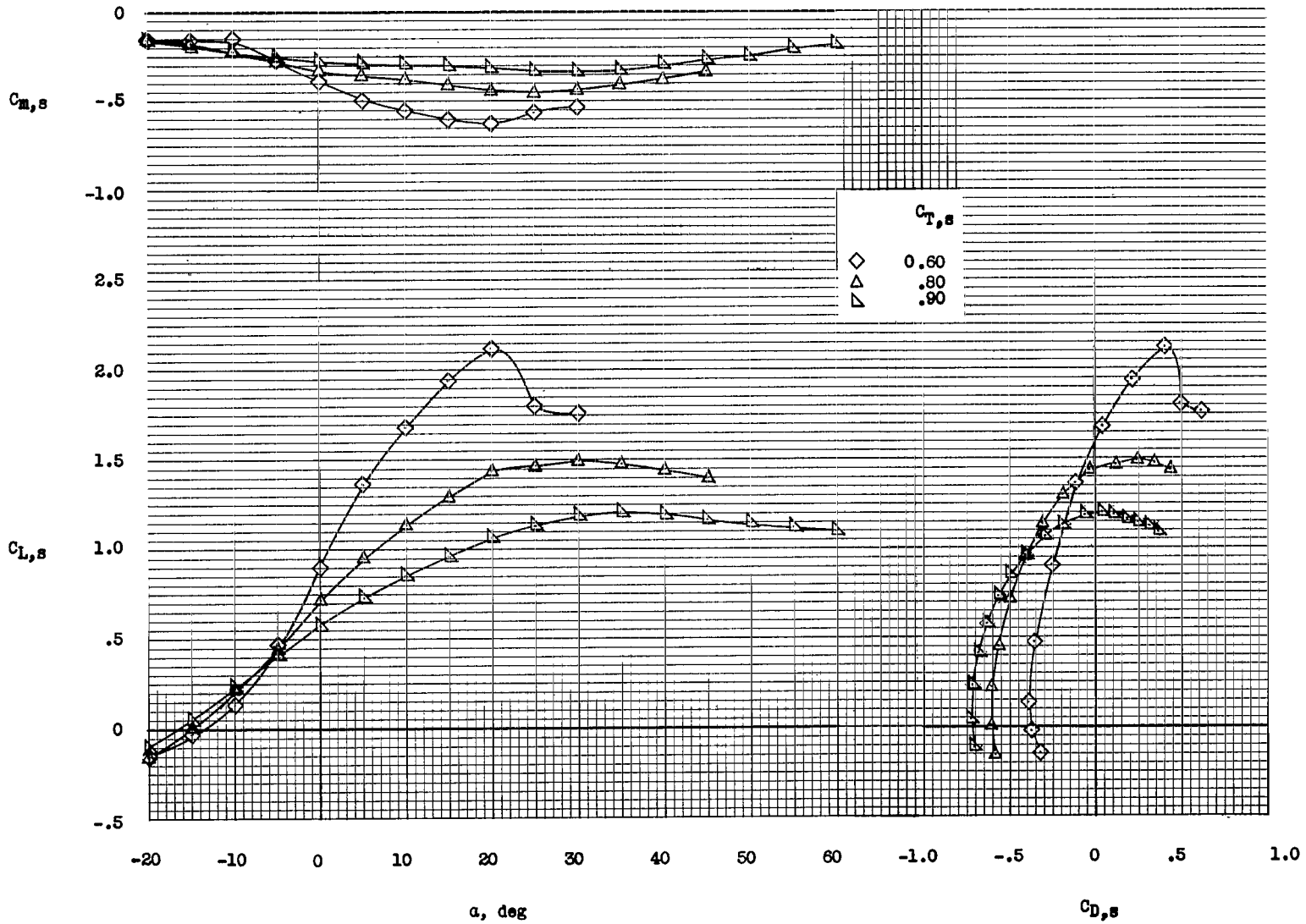
(c) Flow characteristics; $C_{T,s} = 0.80$. L-63-9218

Figure 18.- Continued.



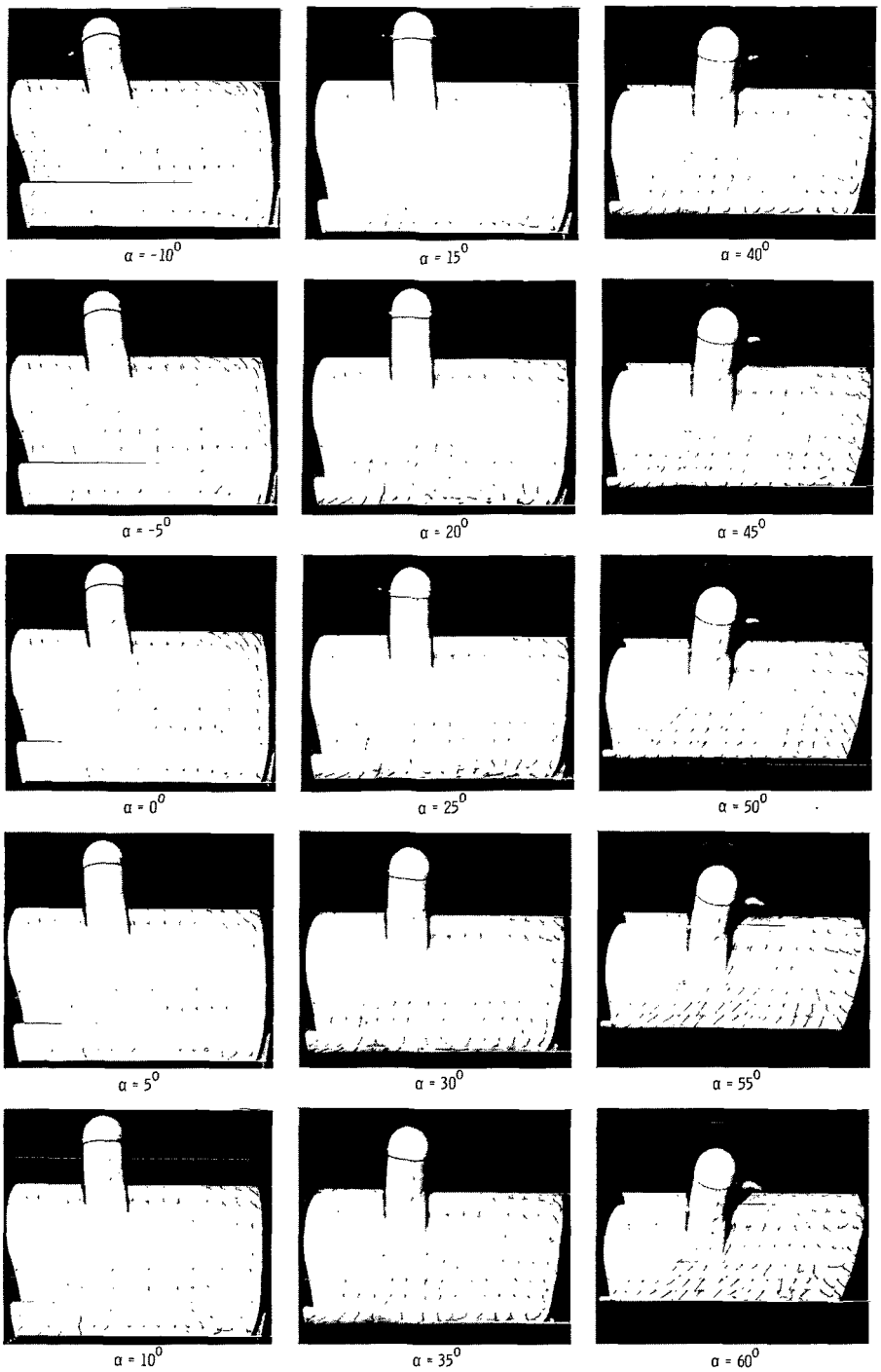
(d) Flow characteristics; $C_{T,s}$ = 0.60. L-63-9219

Figure 18.- Concluded.



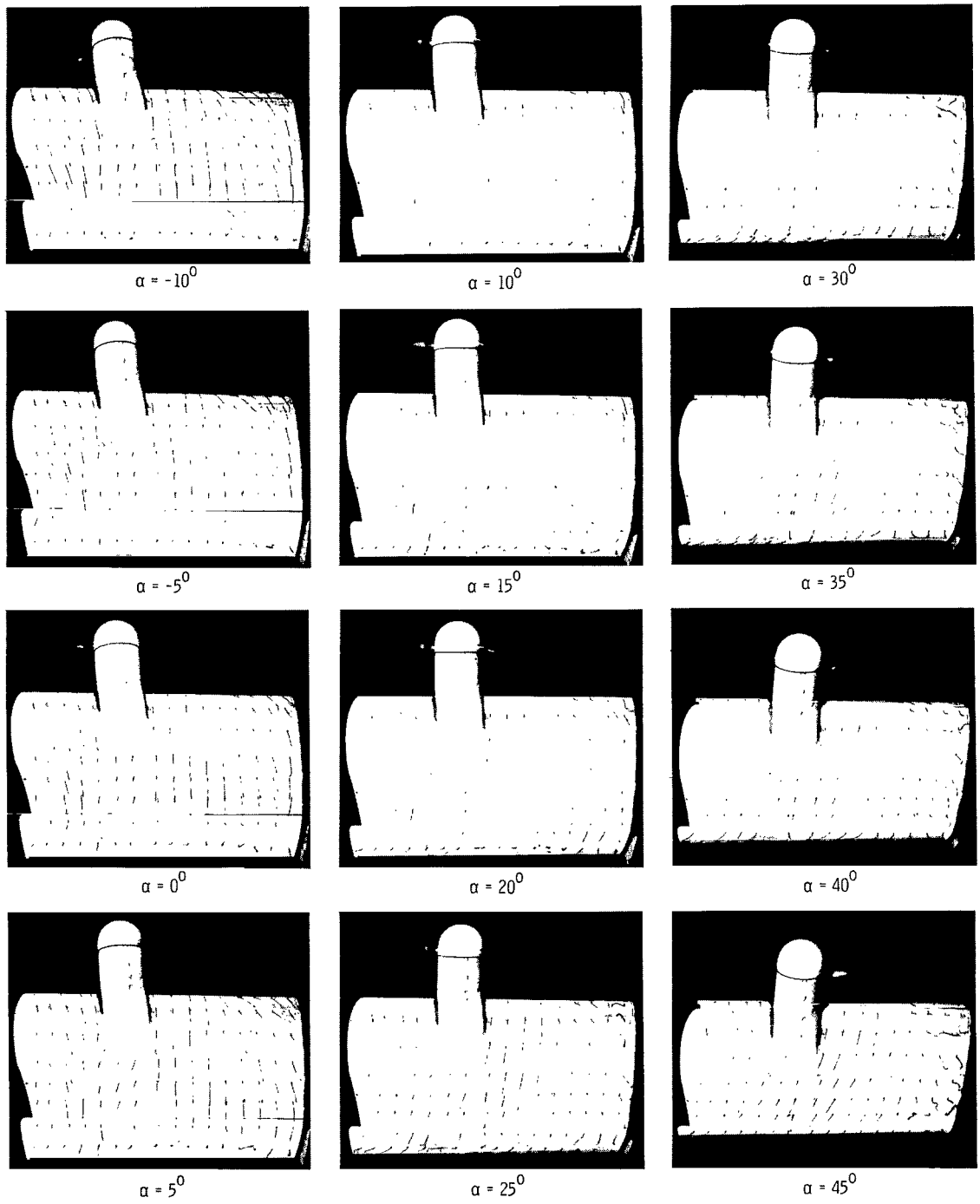
(a) Aerodynamic characteristics.

Figure 19.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and with a Krueger leading-edge flap deflected 80°.



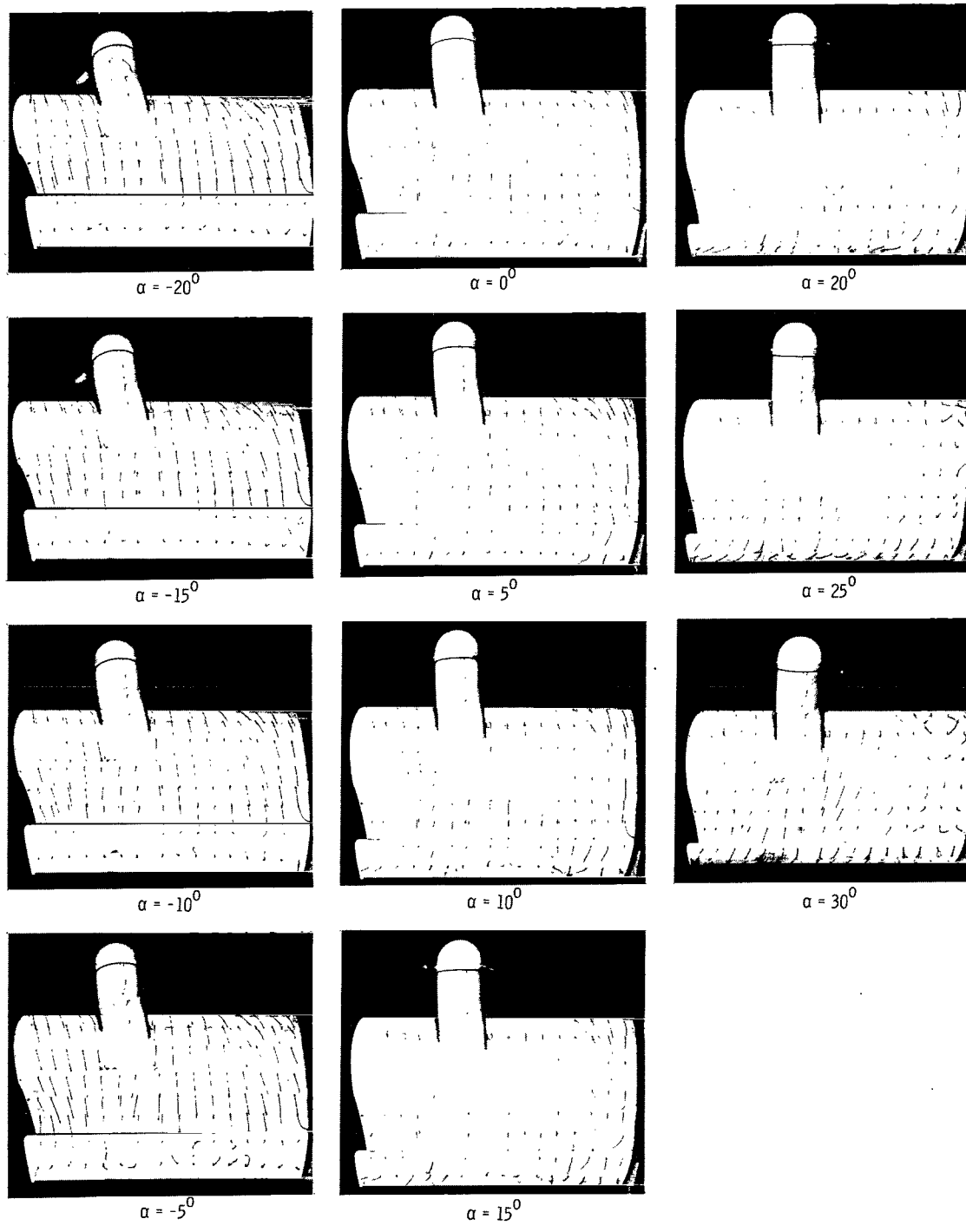
(b) Flow characteristics; $C_{T,s}$ = 0.90. L-63-9220

Figure 19.- Continued.



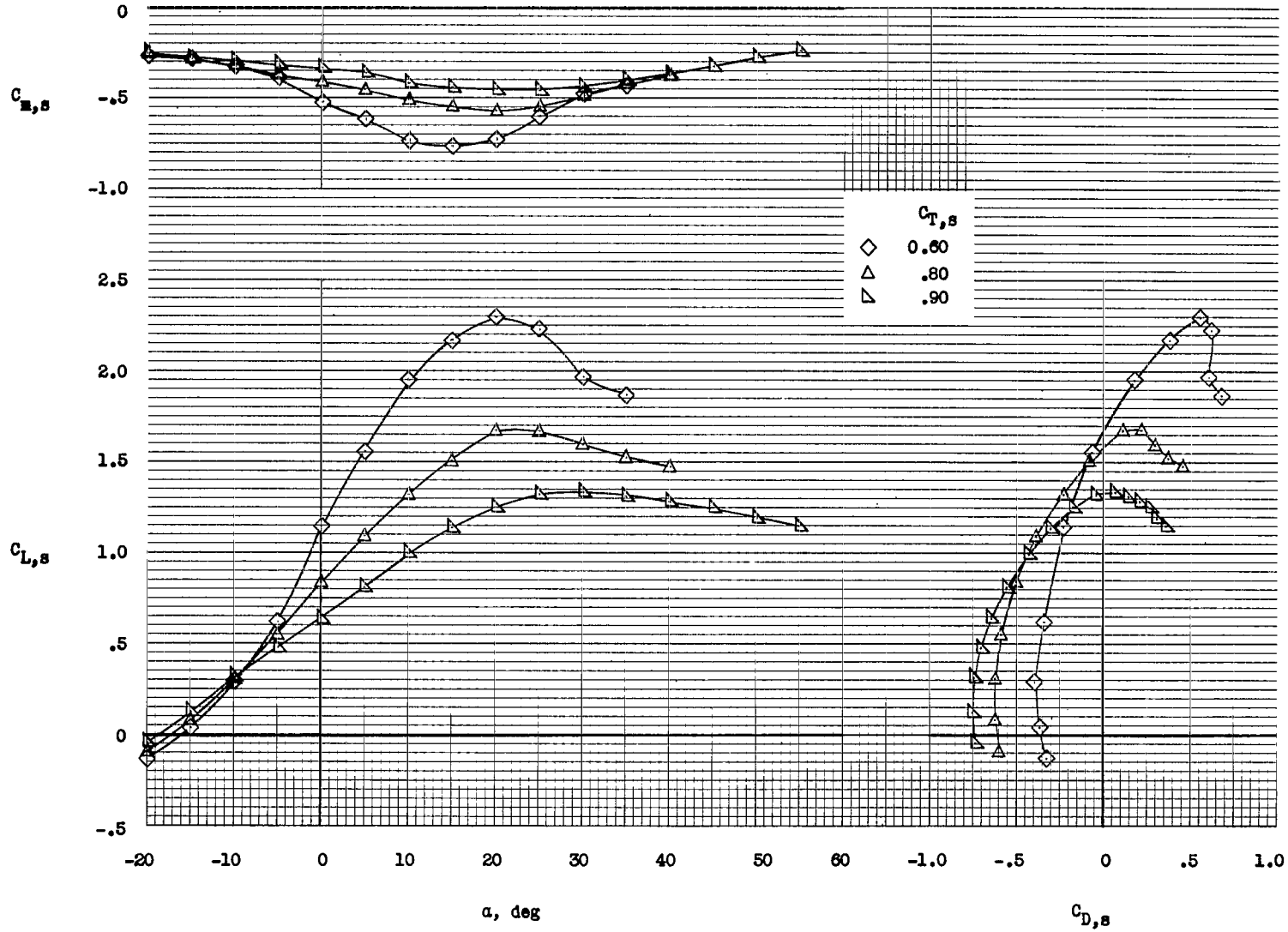
(c) Flow characteristics; $C_{T,s} = 0.80$. L-63-9221

Figure 19.- Continued.



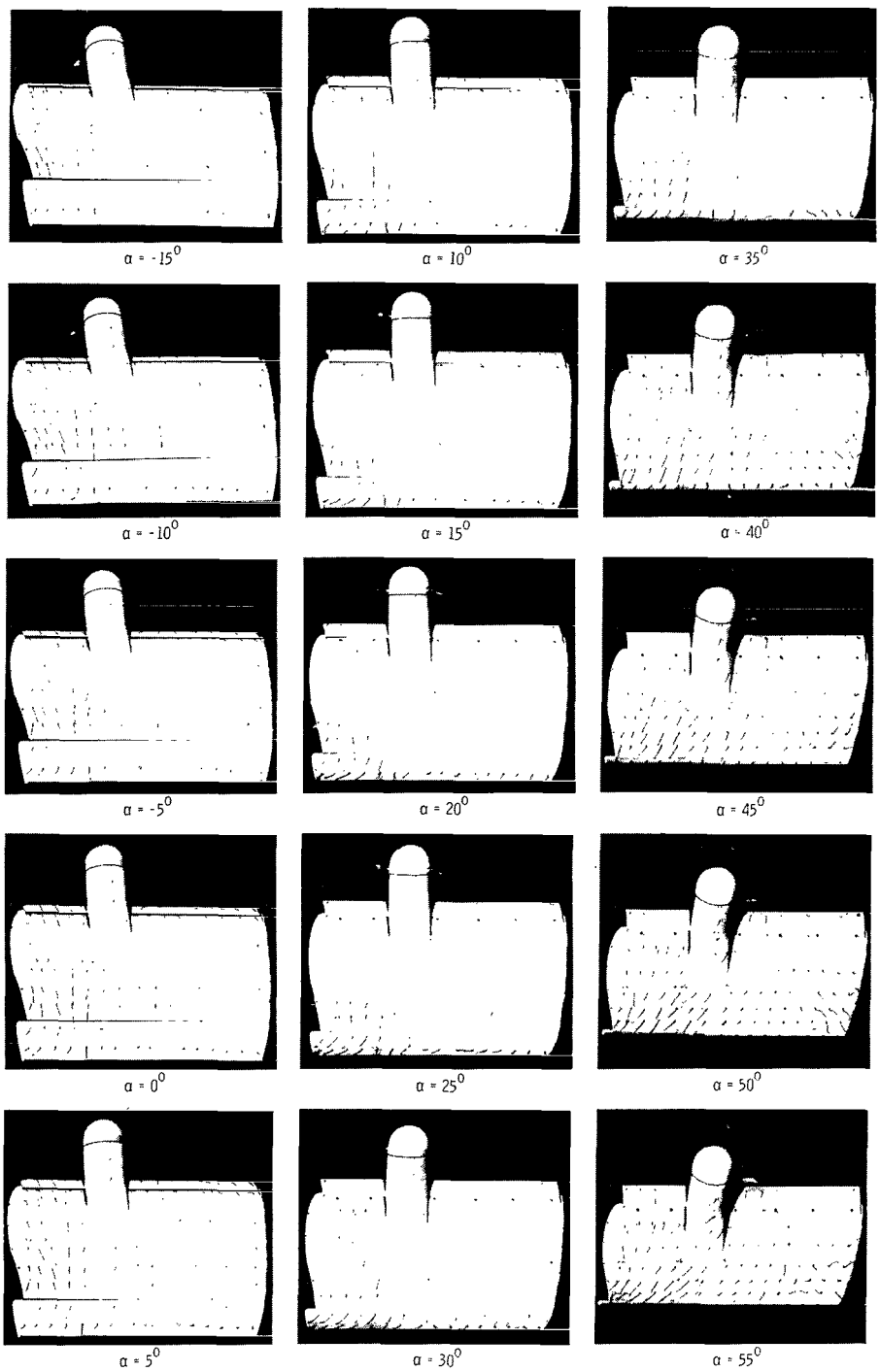
(d) Flow characteristics; $C_{T,S}$ = 0.60. L-63-9222

Figure 19.- Concluded.



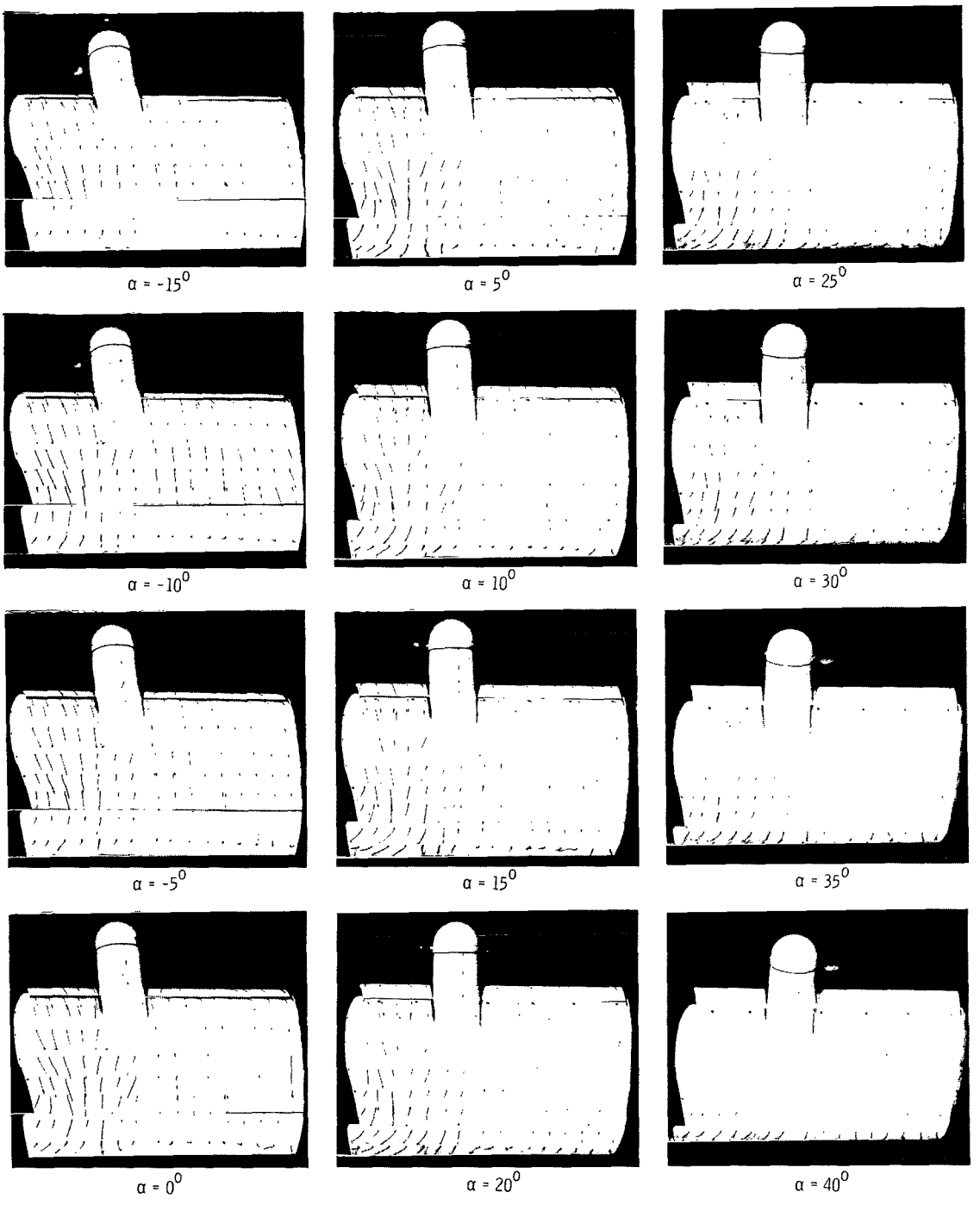
(a) Aerodynamic characteristics.

Figure 20.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and leading-edge slat deflected 20°. $\frac{h}{c}$ = 0.012.



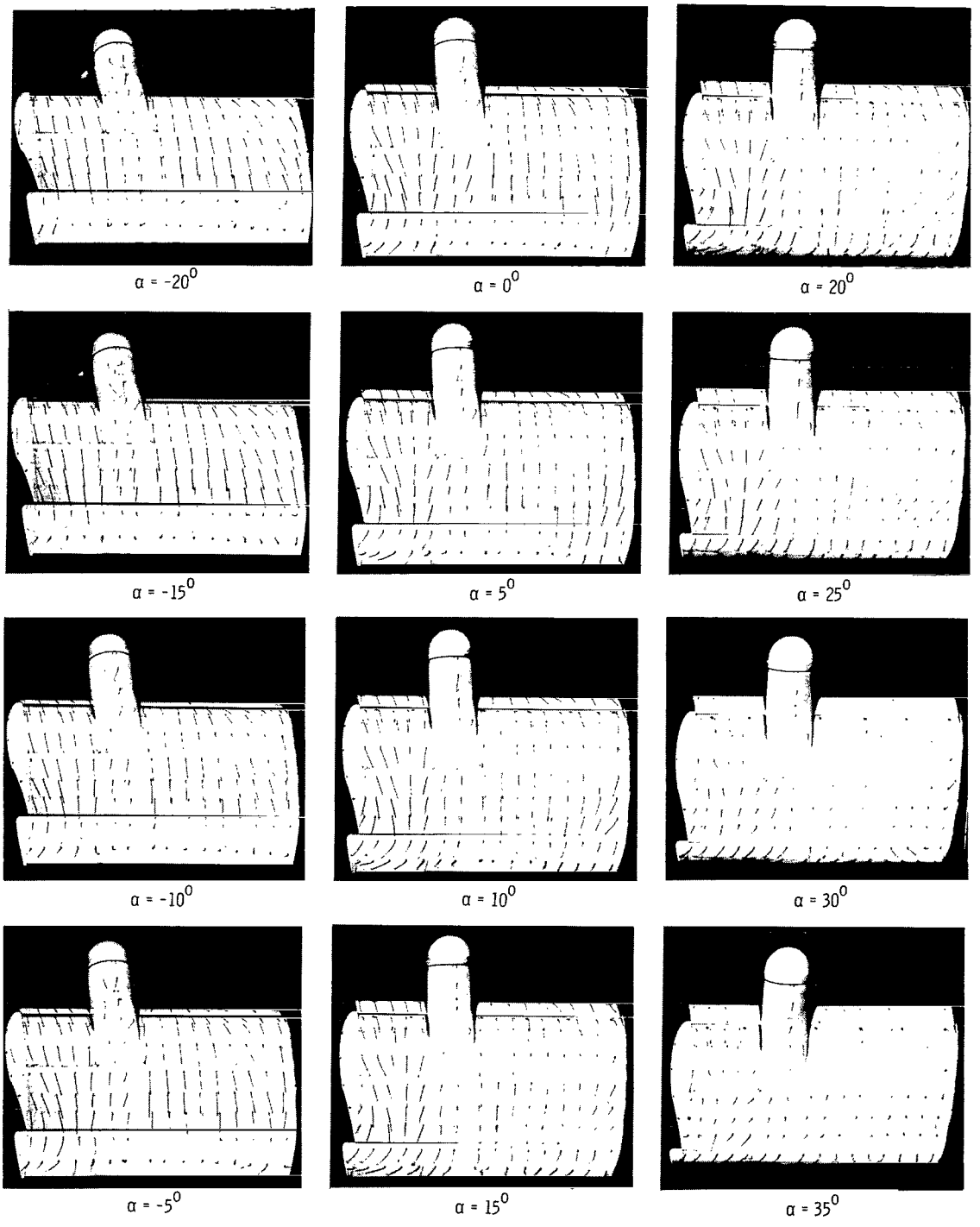
(b) Flow characteristics; $C_{T,s}$ = 0.90. L-63-9223

Figure 20.- Continued.



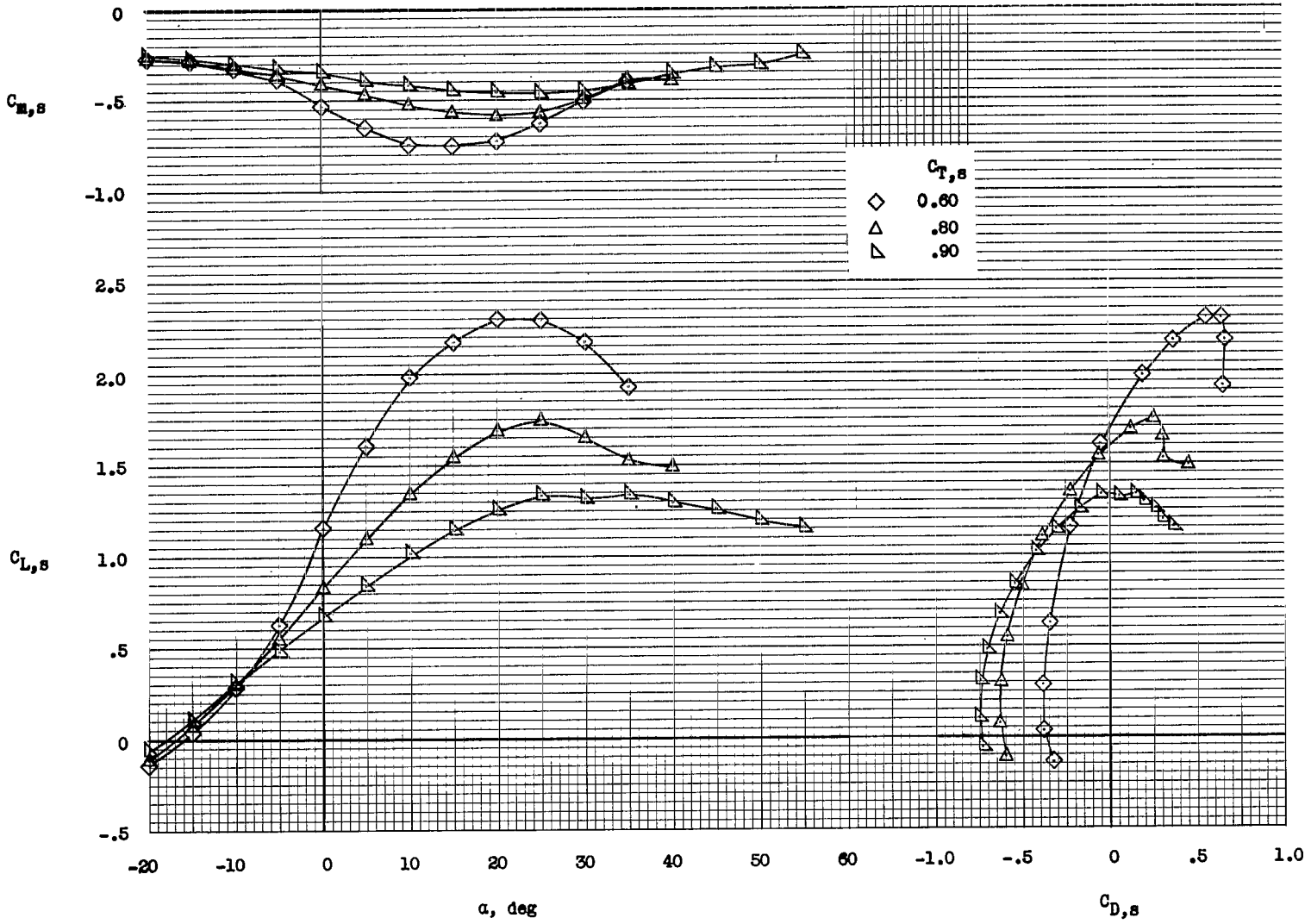
(c) Flow characteristics; $C_{T,s} = 0.80$. L-63-9224

Figure 20.- Continued.



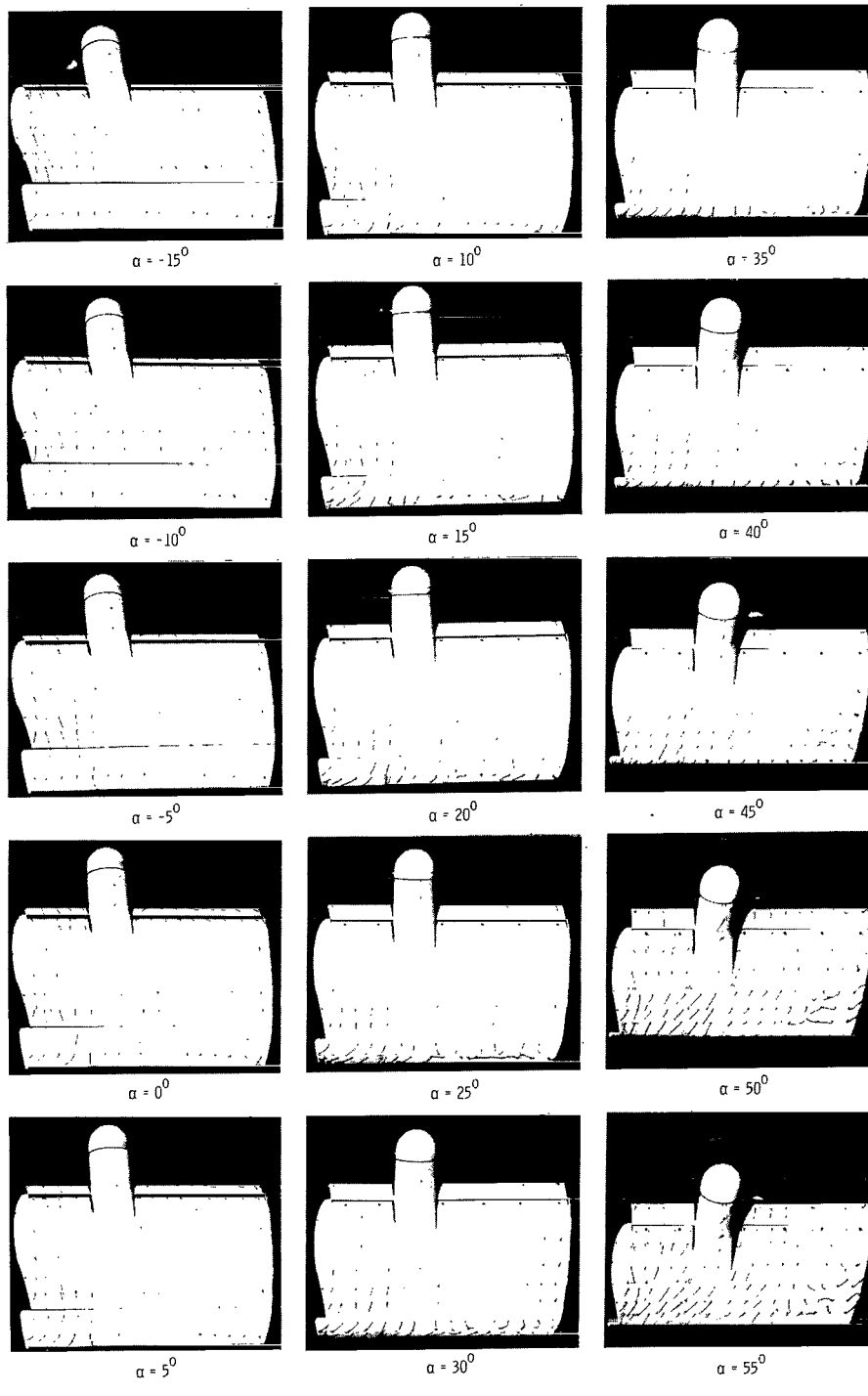
(d) Flow characteristics; $C_{T,s}$ = 0.60. L-63-9225

Figure 20.- Concluded.



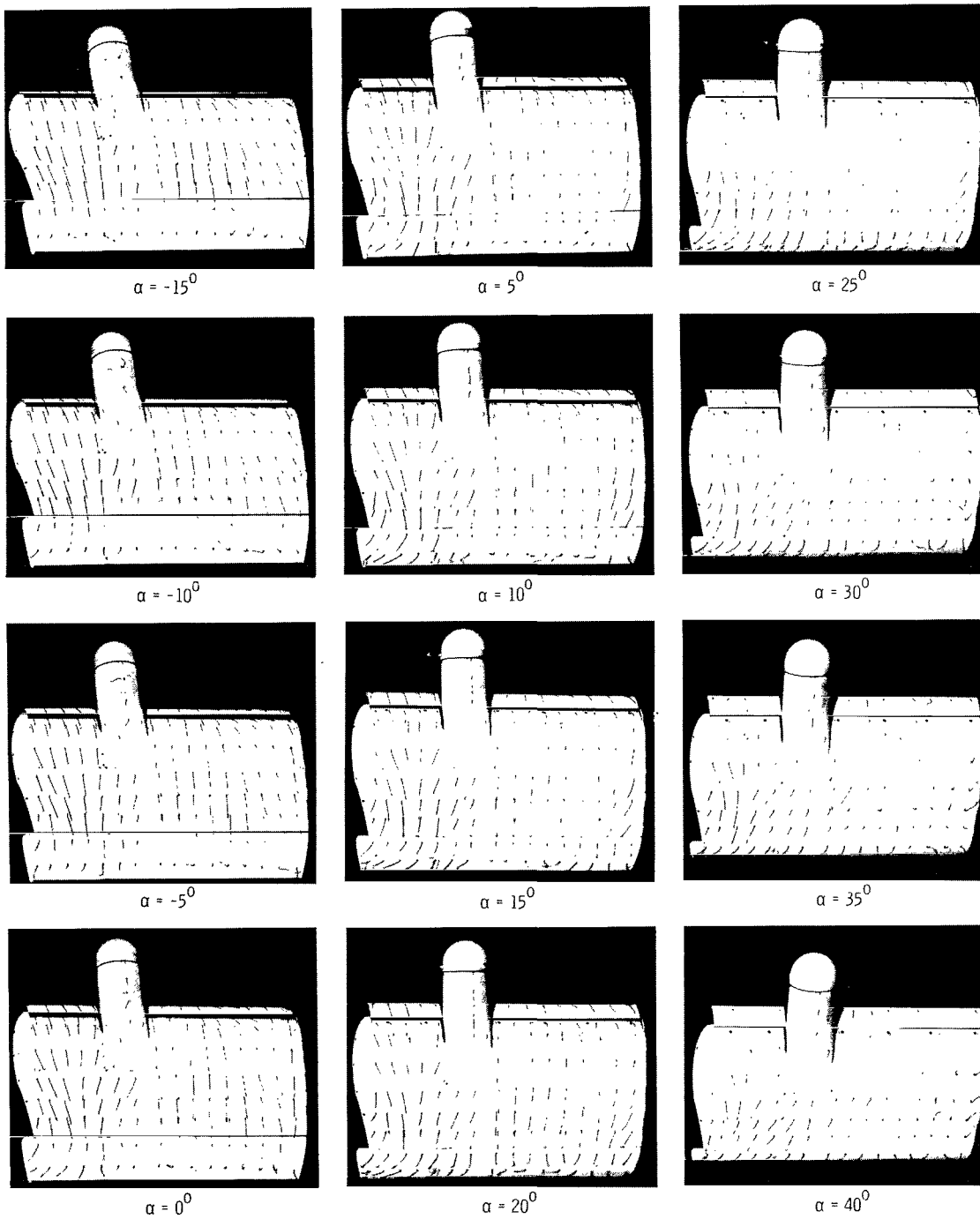
(a) Aerodynamic characteristics.

Figure 21.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and leading-edge slat deflected 20°. $\frac{h}{c} = 0.024$.



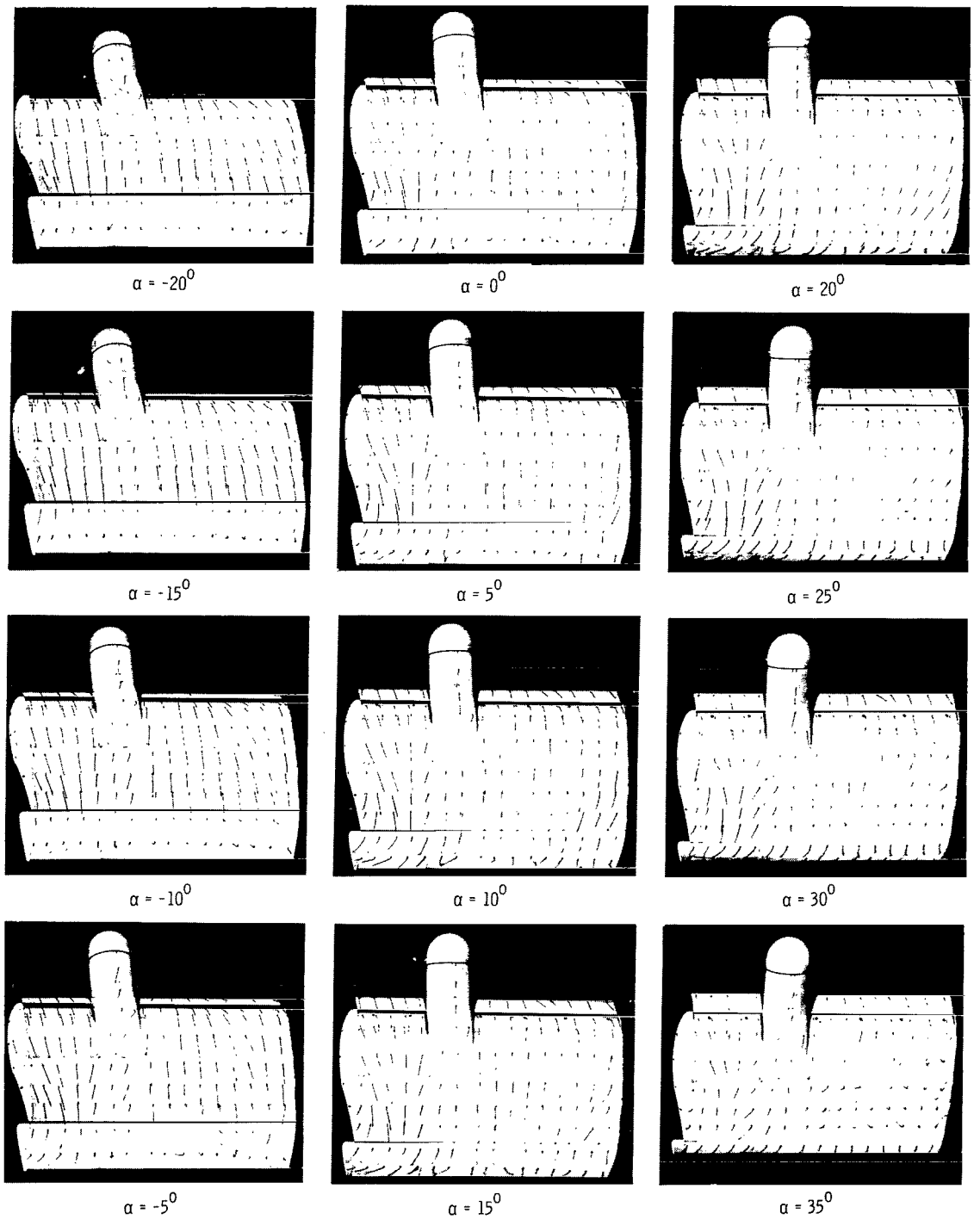
(b) Flow characteristics; $C_{T,s}$ = 0.90. L-63-9226

Figure 21.- Continued.



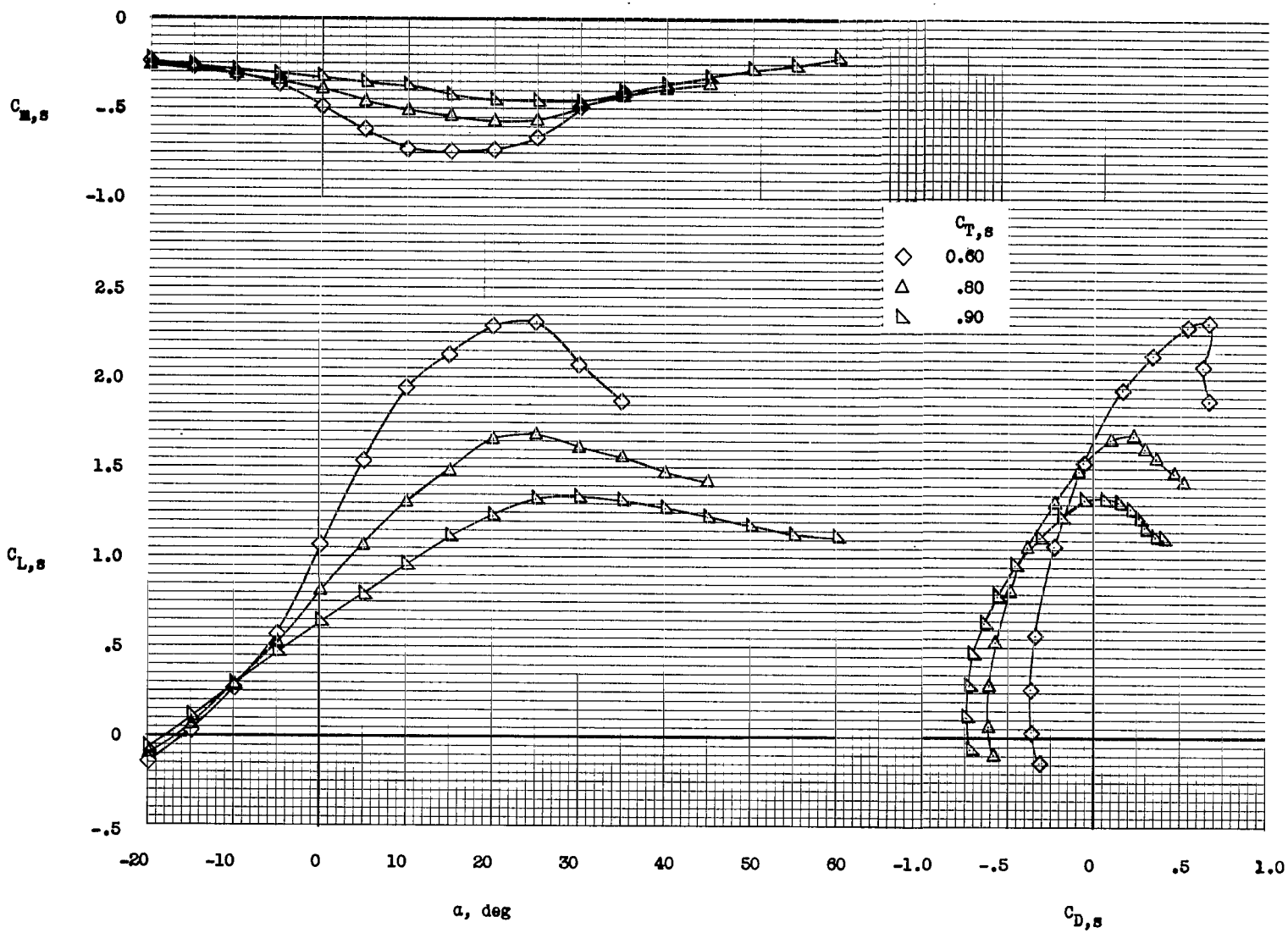
(c) Flow characteristics; $C_{T,s}$ = 0.80. L-63-9227

Figure 21.- Continued.



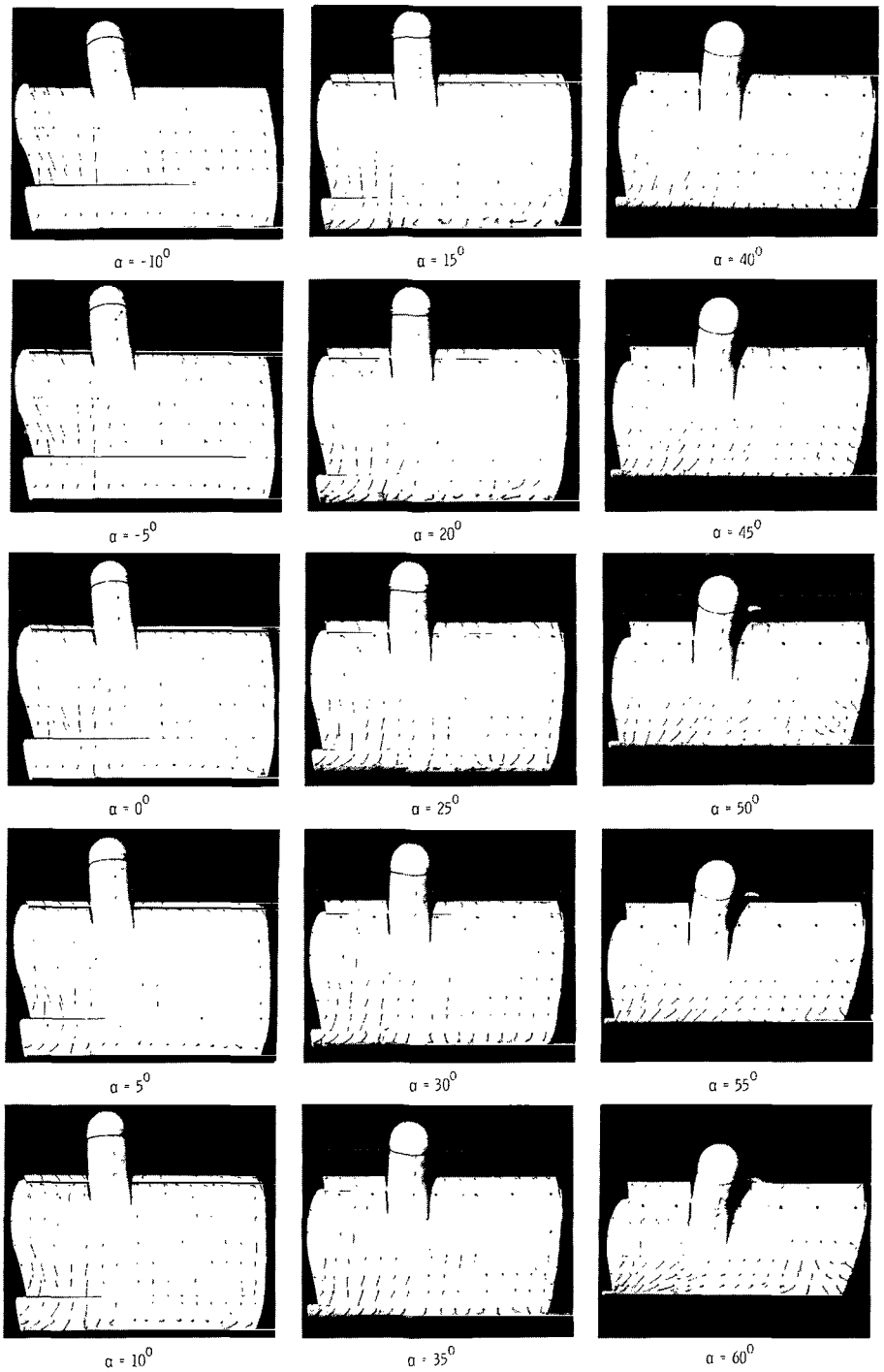
(d) Flow characteristics; $C_{T,s}$ = 0.60. L-63-9228

Figure 21.- Concluded.



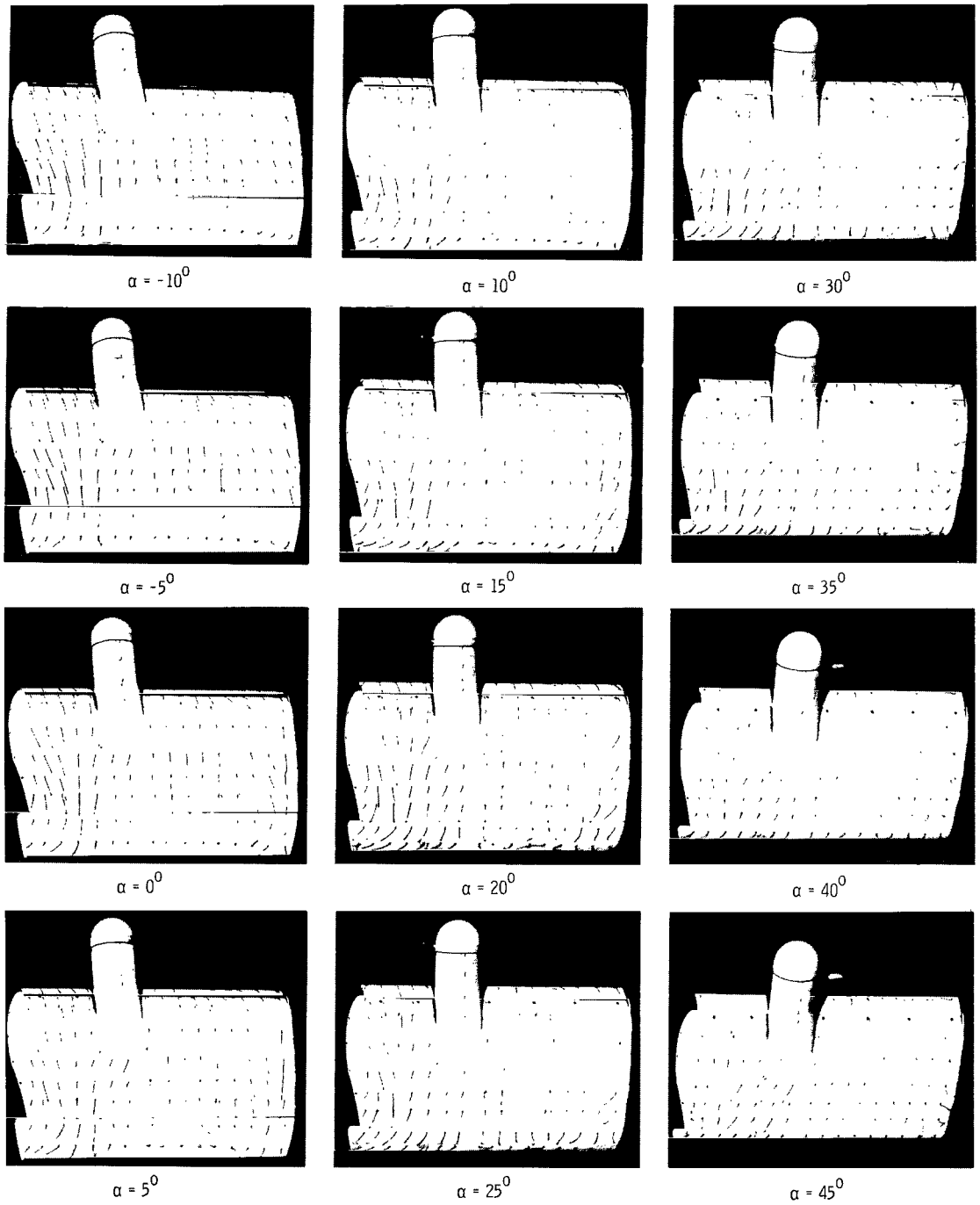
(a) Aerodynamic characteristics.

Figure 22.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and leading-edge slat deflected 30°. $\frac{h}{c} = 0.012$.



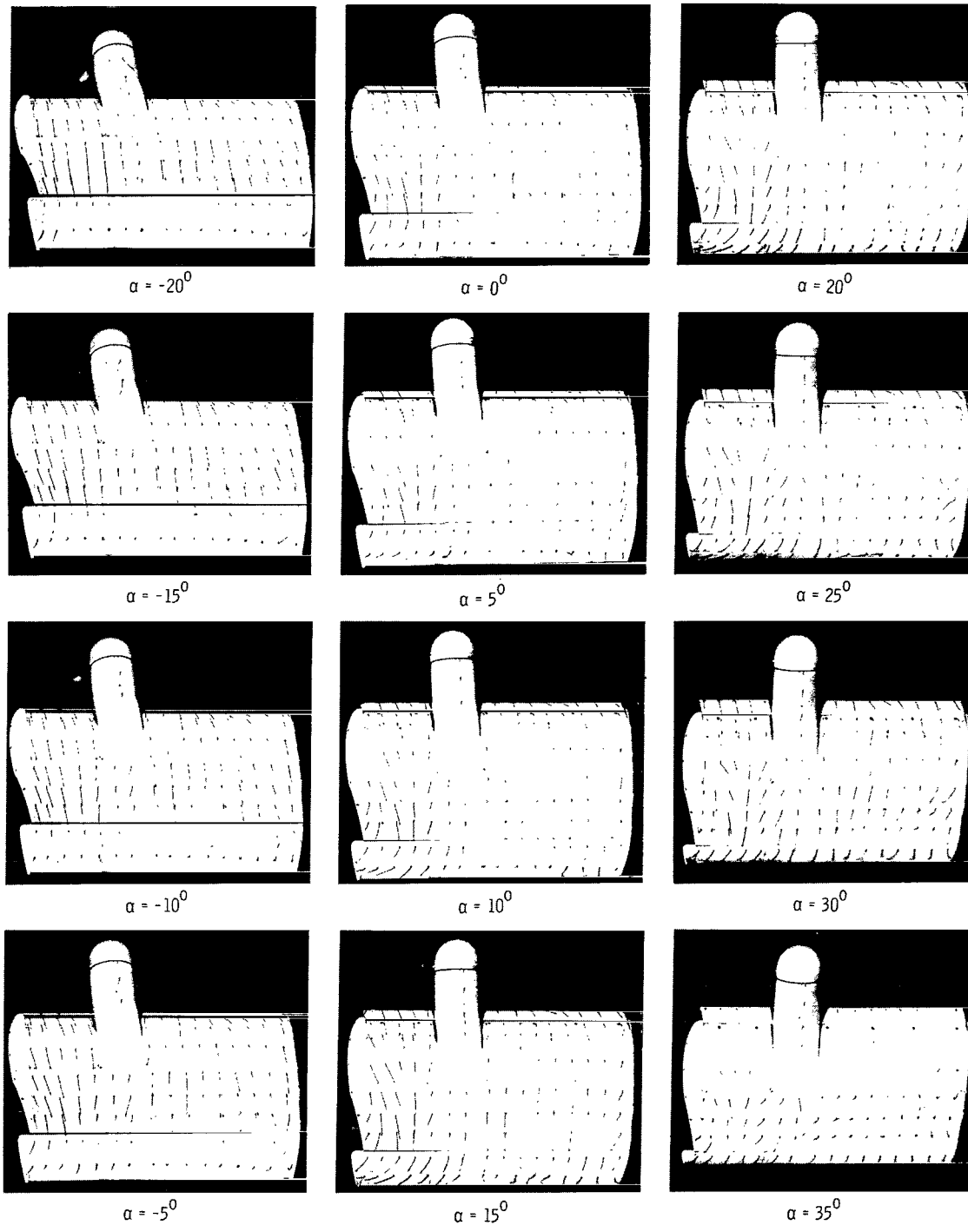
(b) Flow characteristics; $C_{T,s}$ = 0.90. L-63-9229

Figure 22.- Continued.



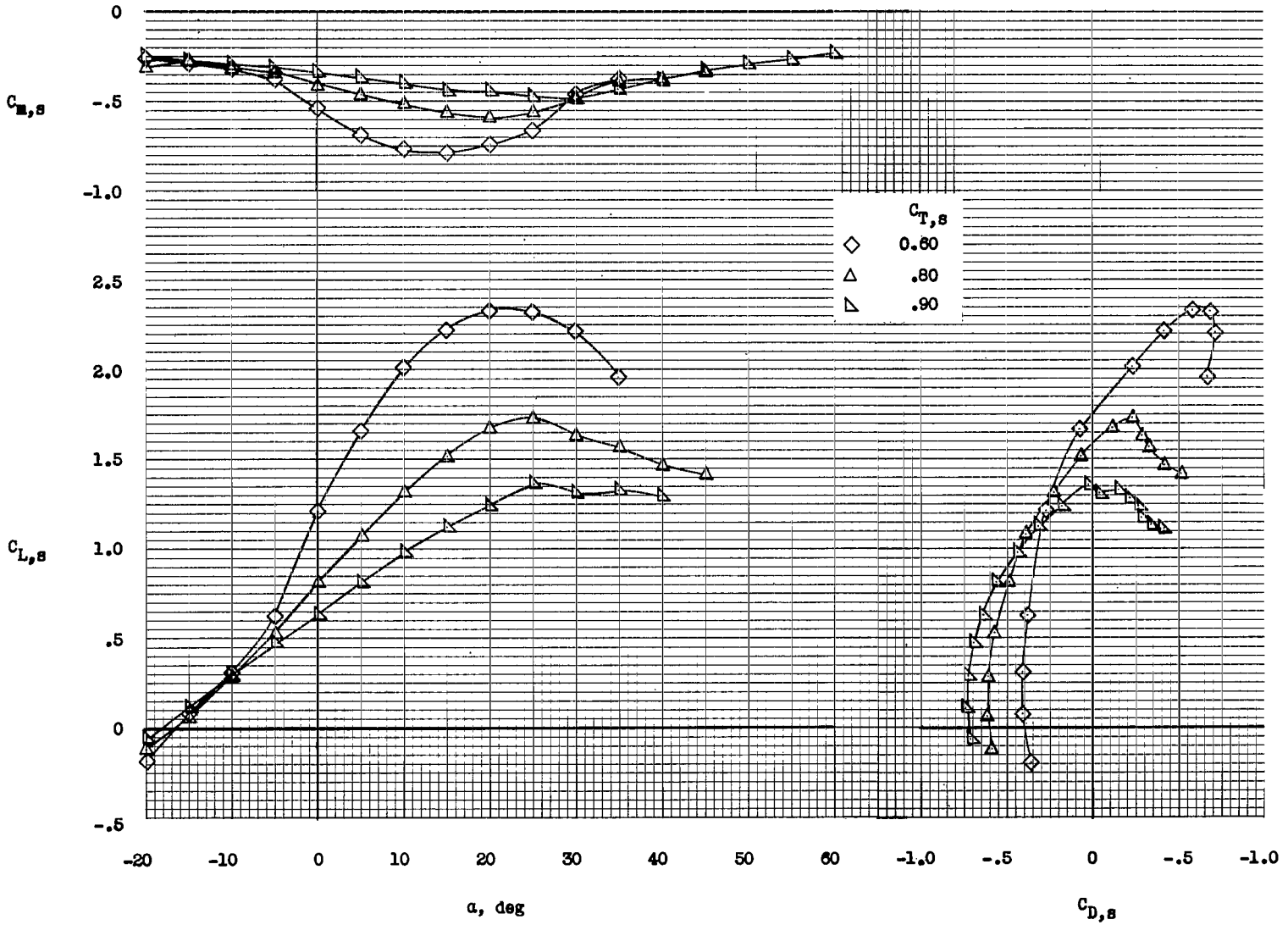
(c) Flow characteristics; $C_{T,s}$ = 0.80. L-63-9230

Figure 22.- Continued.



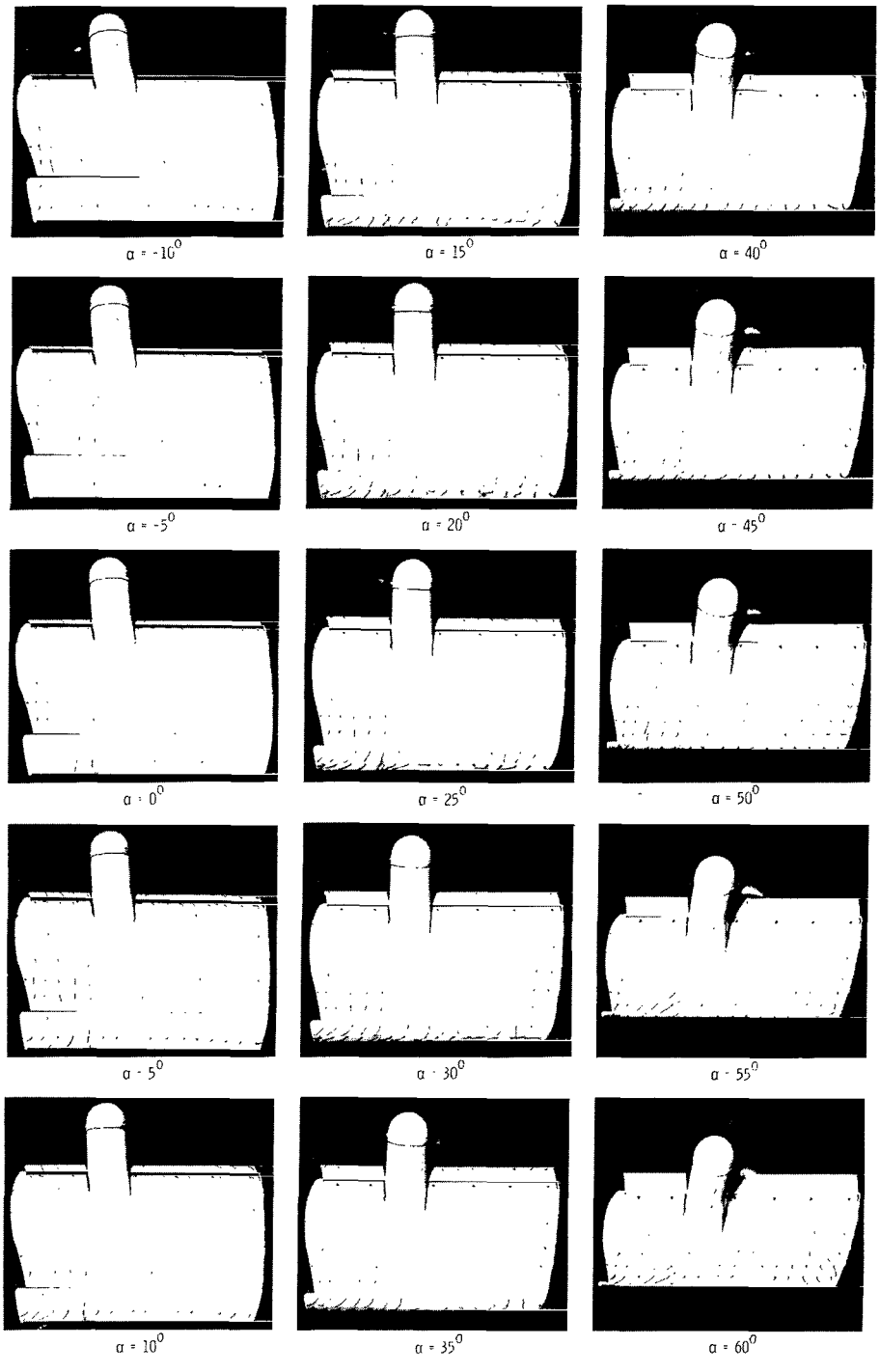
(d) Flow characteristics; $C_{T,s}$ = 0.60. L-63-9231

Figure 22.- Concluded.



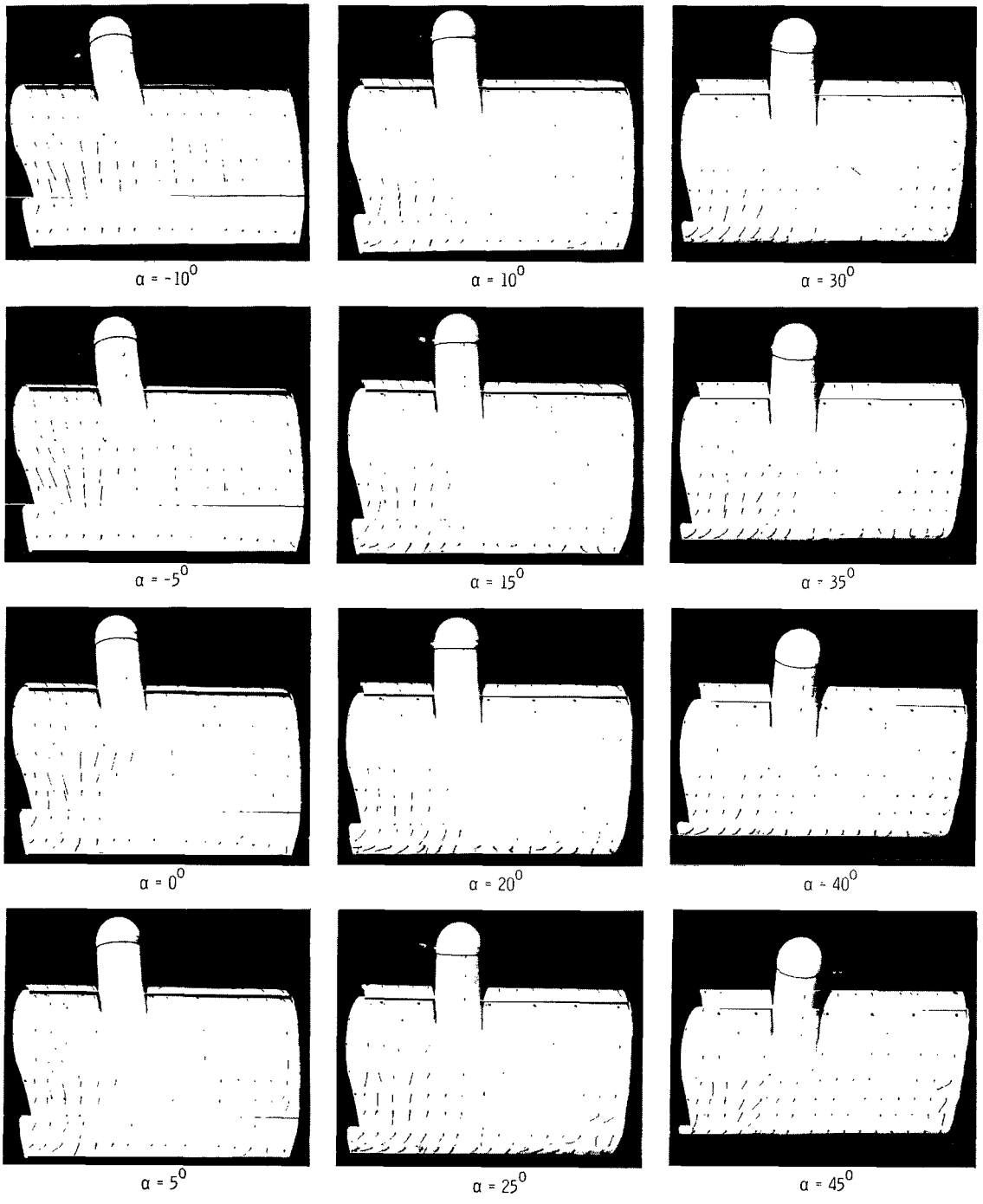
(a) Aerodynamic characteristics.

Figure 23.- Aerodynamic and flow characteristics of the model with trailing-edge flap deflected 50° and leading-edge slat deflected 30°. $\frac{h}{c} = 0.024$.



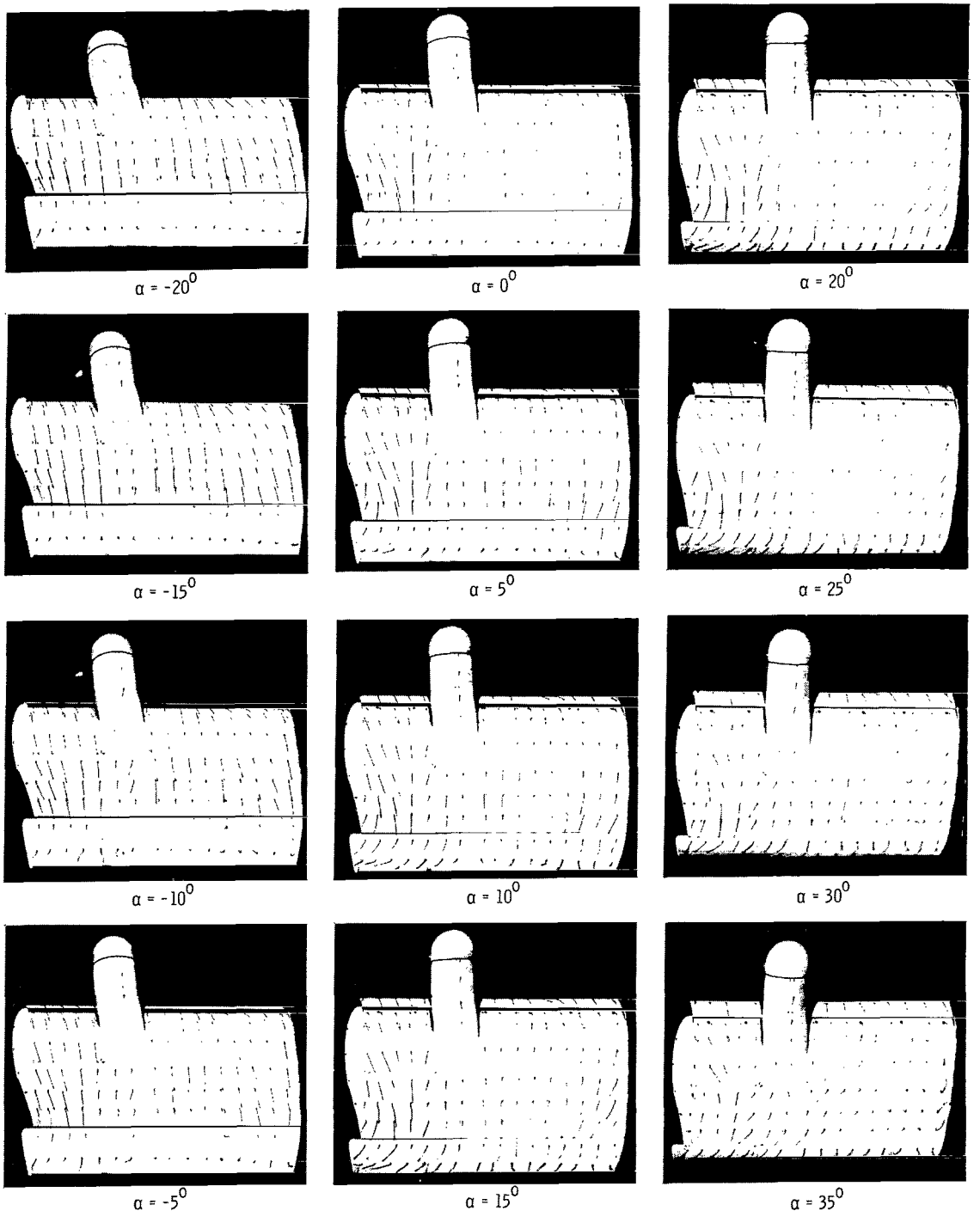
(b) Flow characteristics; $C_{T,s} = 0.90$. L-63-9232

Figure 23.- Continued.



(c) Flow characteristics; $C_{T,s}$ = 0.80. L-63-9253

Figure 23.- Continued.



(d) Flow characteristics; $C_{T,s} = 0.60$. L-63-9234

Figure 23.- Concluded.

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